

BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2018

Senior Final, Part B – Draft 3

Friday, May 4

Note: Please refer to problems by the key:# in the margin: these don't change when problem numbers change due to adding / re-ordering. Thanks! _____

key: 18013 The sequence $17, 8, 1, A, B, C, D, E, F, G, H, I, J, K, 7, 9, 16$ consists of each integer from 1 to 17, each integer used exactly once. Moreover, the sum of each pair of consecutive terms is a perfect square. (For example, $17 + 8 = 25 = 5^2$, $8 + 1 = 9 = 3^2$, and $1 + A$ are all perfect squares.) Find, with explanation, F , the middle number in this sequence.

key: 18023 A bag contains 4 red, 5 blue, and 6 green marbles. Maelle is blindfolded and asked to take some marbles from the bag. Find the smallest number she must take to be certain of getting:

- At least one marble of each colour?
- A matched pair, i.e., two marbles of the same colour?
- Two different matched pairs?
- Two blues and two reds?

key: 17034 Find all possible sequences of consecutive positive integers that sum to 100.

key: 18049 Suppose we have the following array of numbers where in the n th row, the numbers $1, 2, \dots, n$ occur in the even positions, and the numbers $n, n + 1, \dots, 2n - 1$ occur in the odd positions as illustrated below.

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

- Find the 50th number in Row 100.
- Let $f(n)$ the n th term in row n . For example: $f(1) = 1$, $f(2) = 1$, $f(3) = 4$, and $f(4) = 2$. Determine all n for which $f(n) = 2018$.

key: 18057 The parabola $y = ax^2 + bx + c$ has vertex at (t, t) and passes through $(-t, -t)$.

- If $t = 2$ determine a, b, c .
- If $a^2 + b^2 + c^2 = \frac{33}{16}$ determine all possible values of t .
- Determine the value of t for which $a^2 + b^2 + c^2$ is minimized.