

BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2026

Senior Final, Part B

May 1, 2026

1. A certain lottery involves a game with four identical boxes containing balls. One box has 5 black balls and 5 white balls, one has 4 black and 2 white, one has 3 black and no white, and one has 2 black and 4 white. A player first chooses a box at random, then chooses a ball within that box at random. If the ball is black, the player wins; if it is white, the player loses. Occasionally, at the start of the game, a lucky player is given the ability to redistribute the balls among the boxes before playing the game. How should the balls be distributed so that the probability of winning is as large as possible? Explain.
2. You have 100 large jugs, each with a capacity of 10 Litres. For each integer $n = 1, \dots, 100$, there is a jug that contains exactly n mL of water. You are allowed to redistribute the water among the jugs by pouring water from one jug into another as many times as you like subject to the rule that, at each step in the process, the amount of water poured into a jug must equal the amount that is in the jug already (so that the effect of the added water is to double the amount of water in the jug).
 - a) Is it possible to redistribute the water so that, for each $n = 1, \dots, 100$, there is a jug that contains exactly n mL of water, but no jug contains the same amount of water as it did initially? Explain.
 - b) Is it possible to redistribute the water so that five of the jugs each contain exactly 3 mL of water and, for each $n = 6, 7, \dots, 100$, there is a jug that contains exactly n mL of water? Explain.
3. Find the value of the number p that minimizes the sum of the squares of the roots of the following equation:
$$x^2 + (p - 2)x + 2(p + 1) = 0.$$
4. AH and CP are heights of the acute triangle ABC . What is the value of the angle B if it is known that $AC = 2HP$?
5. Let us call a positive integer “nice” if it can be expressed as the sum of a three-digit number abc and a three-digit number cba , where the symbols a , b and c represent digits and the digits a and c are not zero. How many positive integers are nice?