

BRITISH COLUMBIA COLLEGES

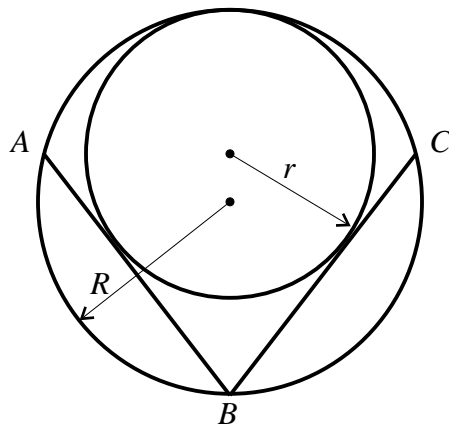
Senior High School Mathematics Contest

Part B Final Round April 30, 1999

1. If $p, q, r,$ and s are consecutive terms of an arithmetic sequence with a common difference of 2, show that $pqrs + 16$ is a perfect square.
2. A string of digits is formed by a computer printing the positive integers beginning with 2000. The string ends when the digits 1999 appear in order for the first time as shown,

200020012002 . . . 1999

- (a) How many digits appear in the string?
 - (b) How many times does the digit '0' appear in the string?
3. The factors of 10000 are listed: $1, 2, 4, \dots, 5000, 10000$. Find the sum of the logarithms of these factors.
 4. A pipe of radius r is suspended in a v -shape trough which itself is contained within a larger pipe with radius R . (See diagram.) Given $AB = BC$, find length AB in terms of r and R .



5. A fuel tank receives a continuous, steady flow of 2,000 litres per hour. The tank experiences a steady rate of fuel usage within each of the 6 consecutive 4-hour periods every day. Every day, usage during these periods is, respectively 6,000, 13,500, 7,300, 10,000, 8,000, and 3,200 litres. Find, in litres, the capacity of the smallest tank which could ensure there would always be at least 200 litres of fuel in the tank. Considering that the cycle could begin at any one of 6 different times, determine the minimum amount of oil needed in the tank in order to begin the process at some point, and determine which of the 6 starting points would successfully handle the task starting with that minimum amount of oil.