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From the archives of the CEMC
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In honour of the 50th anniversary of the Faculty of Mathematics, at the beginning of each month of 2017, a set of five problems from the 54 years of CEMC contests will be posted. Solutions to the problems will be posted at the beginning of the next month. Hopefully, these problems will intrigue and inspire your mathematical mind. For more problem solving resources, please visit `cemc.uwaterloo.ca`.

1. *1973 Junior Mathematics Contest, Question 8*
   A rectangular block with dimensions 4 cm $\times$ 3 cm $\times$ 2 cm has its surface painted red, and is then cut into cubes with edge length 1 cm. The number of cubes having exactly one of its faces painted red is

   (A) 0   **(B)** 4   **(C)** 8   **(D)** 12   **(E)** 24

2. *1969 Junior Mathematics Contest, Question 28*
   If x, y are integers such that $(x - y)^2 + 2y^2 = 54$, then the only values that x can have are

   (A) 3 or 5

   (B) 7 or 3

   (C) -3, 3, 7, -7, 9, or -9

   (D) -3, 3, or 9

   (E) -3, 3, 7 or 9

3. *1978 Descartes Contest, Question 7*
   The twenty volumes comprising an encyclopedia are clearly numbered from 1 to 20. If ten volumes have blue covers, six have red covers, and the remainder have green covers, determine the number of ways the books can be arranged so that no two books of the same colour are side by side.

4. *1972 Ontario Senior Mathematics Problems Competition, Question 6*
   The sum of the terms in an infinite geometric sequence is 8. If the sum of the second and third terms is 3, determine all possible values of r, the common ratio between any two consecutive terms in the series.

5. *1987 Descartes Contest, Question 1b*
   The line $x + y = 1$ is rotated $90°$ clockwise about the origin. Find the equation of the image line.