BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2024

Junior Preliminary

March 2024

1. The integers greater than 2 are arranged in columns as follows:

a	b	c	d	e
-	3	4	5	6
10	9	8	7	-
-	11	12	13	14
18	17	16	15	-
and		so		on

If one continues this pattern, the number 2024 will occur in the column:

(A) a (B) b (C) c (D) d (E) e

2. The smallest positive integer having the remainders 2, 3 and 6 when divided by 3, 5, and 11, respectively, lies between:

(A) 41 and 50 (B) 61 and 70 (C) 71 and 80 (D) 81 and 90 (E) 91 and 100

3. An examination in three subjects, Algebra, Biology, and Chemistry, was taken by 41 students. The following table shows how many students failed in each subject, as well in the various combinations:

Subject	A	B	C	A,B	A,C	B,C	A,B,C
Number failed	12	5	8	2	6	3	1

(For instance, 5 students failed in Biology, among whom there were 3 who failed both Biology and Chemistry, and just 1 of these failed all three subjects.) The number of students who passed all three subjects is:

(A) 4 (B) 15 (C) 26 (D) 36 (E) 37

4. A rhombus is a shape with exactly four sides that are all equal in length. Each side of a rhombus has length 10. The sum of the squares of the diagonals equals:

(A) 40 (B) 50 (C) 100 (D) 200 (E) 400

5. Maddie walks her dog Clyde to a creek and returns home by the same route. They always walk 2 km/hr when going uphill, 6 km/hr when going downhill, and 3 km/hr when on level ground. If their total walking time is 2 hours, then the total distance they walked, in km, is:

(A) 3 (B) 4 (C) 6 (D) 7 (E) 12

6. An organization of 100 people wishes to set up a telephone call system. The initial contact person calls three other persons, each of whom calls three others, and so on, until all persons in the organization have been contacted. The maximum number of people who do NOT need to make a call is:

(A) 33 (B) 34 (C) 66 (D) 67 (E) 75

7. If $a^x = c^q = b$ and $c^y = a^z = d$ where $bd \neq 0$, then:

   (A) $xy = qz$ (B) $\dfrac{x}{y} = \dfrac{q}{z}$ (C) $x^y = q^z$ (D) $x - y = q - z$ (E) $x + y = q + z$

8. In a carnival game, a player tosses a coin from a distance of about 5 feet onto a very large table tiled with 2×2-inch squares. If the coin, $\frac{3}{4}$ inches in diameter, lands entirely within a square, then the player wins; otherwise, the player loses. Assuming that the coin always lands on its face, the probability that a player wins is closest to:

   (A) about $\frac{1}{10}$ (B) about $\frac{1}{5}$ (C) about $\frac{1}{4}$ (D) about $\frac{1}{3}$ (E) about $\frac{2}{5}$

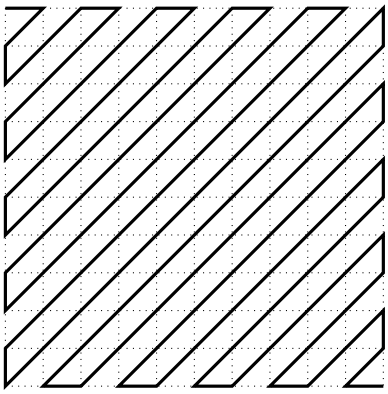
9. A rectangular $4 \times 3 \times 2$ block has its surface painted red, and then is cut into cubes with each edge 1 unit. The number of cubes having exactly one of its faces painted red is:

   (A) 0 (B) 4 (C) 8 (D) 12 (E) 16

10. The number of integers between 100 and 1000 such that the sum of their digits is 10 is:

    (A) 36 (B) 54 (C) 55 (D) 62 (E) 63

11. Shown is a 10×10 square. Find the length of the dark line starting at the upper left hand corner and ending at the lower right hand corner.



    (A) $20 + 110\sqrt{2}$ (B) $22 + 64\sqrt{2}$ (C) $20 + 100\sqrt{2}$ (D) $22 + 100\sqrt{2}$ (E) $20 + 90\sqrt{2}$

12. Some time after school has ended, there are a group of students and teachers still in the gym. First, fifteen students leave, then there are two teachers per student. Then 45 teachers leave, and there are 5 students per teacher. Find the number of teachers in the gym at the beginning.

    (A) 40 (B) 43 (C) 45 (D) 48 (E) 50