

# BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2025

## Senior Final, Part A

May 2, 2025

1. If  $x + y + z = 1$  and  $x^2 + y^2 + z^2 = 3$ , then the value of  $xy + xz + yz$  is:  
(A) 1                      (B) -1                      (C) 2                      (D) -2                      (E) 4
2. Nicole and Adrienne just became friends with Harmony, and they want to know when her birthday is. Harmony gives them a list of twelve possible dates:  
March 1, 26  
May 18, 28  
June 16, 18, 20  
September 1, 16, 28  
November 3, 18

Harmony then tells Nicole the month and Adrienne the day of her birthday. Nicole and Adrienne then have the following conversation:

Nicole: I don't know when Harmony's birthday is, but I know that Adrienne doesn't know either.

Adrienne: At first I didn't know when Harmony's birthday is, but I know now.

Nicole: I STILL DON'T know when Harmony's birthday is.

What month is Harmony's birthday?

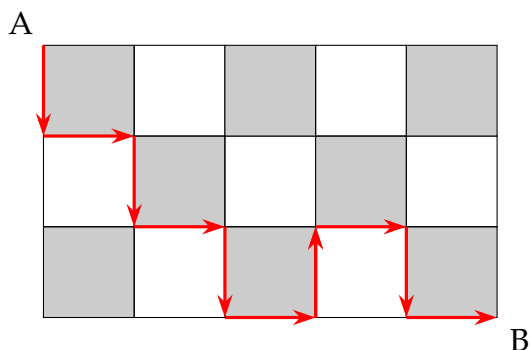
- (A) March                      (B) May                      (C) June                      (D) September                      (E) November
3. The largest prime factor of  $3^{14} + 3^{13} - 12$  is:  
(A) 3                      (B) 7                      (C) 13                      (D) 29                      (E) 73
4. A function  $f$  is defined as follows

$$f(x) = \frac{ax + b}{cx + d}$$

where  $a, b, c$  and  $d$  are constants. Suppose that  $f(0) = 1$ ,  $f(1) = 0$  and  $f(2) = 3$ . Find  $f(3)$ .

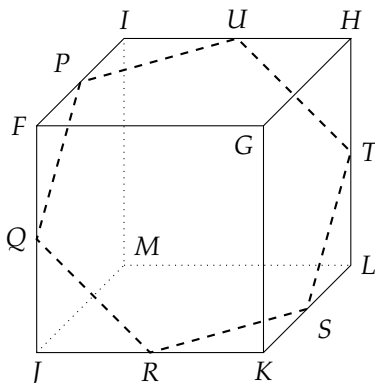
- (A) 0                      (B) 1                      (C) 2                      (D) 7                      (E) 10
5. Two cyclists are  $k$  miles apart and start cycling at the same time. If they cycle in the same direction, the faster cyclist will pass the slower cyclist in  $r$  hours. If they cycle towards each other, they will pass each other in  $t$  hours. The ratio of the speed of the faster cyclist to the speed of the slower cyclist is  
(A)  $\frac{r+t}{r-t}$                       (B)  $\frac{r}{r-t}$                       (C)  $\frac{r+t}{r}$                       (D)  $\frac{r}{t}$                       (E)  $\frac{r+k}{t-k}$

6. A deck of cards contains three red, six green and  $k$  blue cards ( $k \geq 1$ ). If two cards are drawn at random without replacement, you are equally likely to draw two cards of the same colour as two different colours. Calculate  $k$ .
- (A) 5                      (B) 7                      (C) 13                      (D) 15                      (E) 19
7. Fifteen tiles are arranged as shown. An ant walks along the edges of the tiles, always keeping a black tile on its left. The ant never traverses the same edge twice.



How many different routes could the ant take to get from A to B?

- (A) 8                      (B) 4                      (C) 2                      (D) 10                      (E) 6
8. Given a cube (with corners  $FGHIMJKL$ ), mid-points ( $PQRSTU$ ) of six of the twelve edges of the cube are joined to form a regular hexagon. Find the ratio of the area of the hexagon to the surface area of the cube.



- (A)  $\sqrt{2} : 4$                       (B)  $\sqrt{2} : 8$                       (C)  $\sqrt{3} : 4$                       (D)  $\sqrt{3} : 8$                       (E)  $\sqrt{6} : 12$
9. In Canada's Got Talent, three judges vote on four finalists: Kathryn, Mei-ling, Nicolas, and Pardeep. The judges rank the finalists without ties. In how many ways can the judges rank the finalists so that two of the judges agree in their order of preference while the third differs? Note: For any natural number  $n$ ,  $n! = 1 \times 2 \times 3 \times \cdots \times n$ .
- (A)  $3! \times 4!$                       (B)  $3 \times 24!$                       (C)  $3! \times 23$                       (D)  $\frac{3 \times 24!}{22!}$                       (E)  $3! \times 23 \times 24$

10. A deck of 16 cards contains 4 Jacks, 4 Queens, 4 Kings, 4 Aces. I shuffle the deck and draw 2 cards at random. I then tell you (truthfully) that I have at least one ace. What is the probability that I have two aces?
- (A)  $\frac{1}{5}$       (B)  $\frac{1}{6}$       (C)  $\frac{1}{9}$       (D)  $\frac{3}{16}$       (E)  $\frac{2}{15}$