# BRITISH COLUMBIA SECONDARY SCHOOL MATHEMATICS CONTEST, 2015
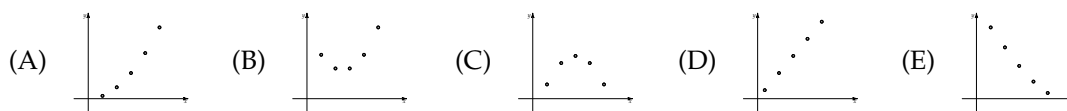
**Senior Preliminary**

**Wednesday, April 1**

1. The volume of a cube of side length $3^n$ cm is $9^{\left(3^3\right)}$ cm$^3$. The value of $n$ is:

   (A) 4      (B) 6      (C) 12      (D) 18      (E) 27

2. Alex draws five circles with radii 1 cm, 2 cm, 3 cm, 4 cm and 5 cm. Then for each circle she plots the point $(C, A)$, where $C$ is its circumference in cm and $A$ is its area in square centimetres. Her graph could look like:
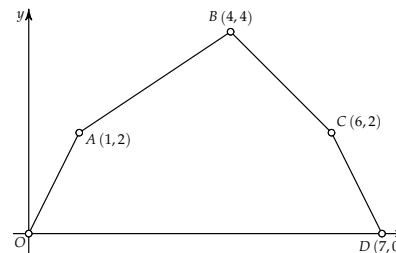
   (A)    (B)    (C)    (D)    (E)

3. Recall that $n! = n \times (n-1) \times (n-2) \times \cdots \times 2 \times 1$. Only one of the expressions below is a perfect square. It is:

   (A) $\dfrac{23! \cdot 24!}{3}$    (B) $\dfrac{24! \cdot 25!}{3}$    (C) $\dfrac{25! \cdot 26!}{3}$    (D) $\dfrac{26! \cdot 27!}{3}$    (E) $\dfrac{27! \cdot 28!}{3}$

4. The area of the pentagon $OABCD$ is:

   (A) 16      (B) 15      (C) 14

   (D) 18      (E) 17

5. If $x + \dfrac{1}{x} = 5$, then the value of $x^3 + \dfrac{1}{x^3}$ is:

   (A) 110      (B) 115      (C) 125      (D) 140      (E) 145

6. The sum of the first $n$ terms of a sequence is $n(n-1)(2n+3)$. The 11$^{\text{th}}$ term of the sequence is:

   (A) 2750      (B) 2070      (C) 680      (D) 460      (E) 340

7. The number of integer solutions $(P, Q)$ to the equation

$$\frac{P}{Q} - \frac{Q}{P} = \frac{P+Q}{PQ}$$

   where $1 \le P \le 9$ and $1 \le Q \le 9$, is:

   (A) 1      (B) 8      (C) 16      (D) 72      (E) 81

8. The number of triangles formed by the intersection points of the lines in the diagram is:

   (A) 25          (B) 35          (C) 36

   (D) 43          (E) None of these

9. Consider a regular hexagon $ABCDEF$. Triangles are formed by choosing three of the vertices $A$, $B$, $C$, $D$, $E$, and $F$. Two such triangles are distinct if they have at least one different vertex, even though they may be congruent. The number of distinct such triangles that have at least two equal sides is:

   (A) 3          (B) 6          (C) 8          (D) 9          (E) 12

10. In the diagram, six regular hexagons surround a regular hexagon of side length 1. The area of triangle $ABC$ is:

   (A) $2\sqrt{3}$          (B) $3 + 2\sqrt{3}$          (C) $1 + 3\sqrt{2}$

   (D) $2 + 2\sqrt{3}$          (E) $3\sqrt{3}$

11. Donny drove her new car on a trip for a whole number of hours, averaging 55 kilometers per hour. At the beginning of the trip the odometer displayed $abc$, where $abc$ is a three digit number with $a \geq 1$ and $a + b + c \leq 7$. At the end of the trip, the odometer displayed $cba$. The value of $a^2 + b^2 + c^2$ is:

   (A) 26          (B) 27          (C) 36          (D) 37          (E) 41

12. A square in the coordinate plane has vertices whose $y$-coordinates are 1, 3, 6, and 8. The area of the square is:

   (A) 25          (B) 29          (C) 36          (D) 64          (E) 121