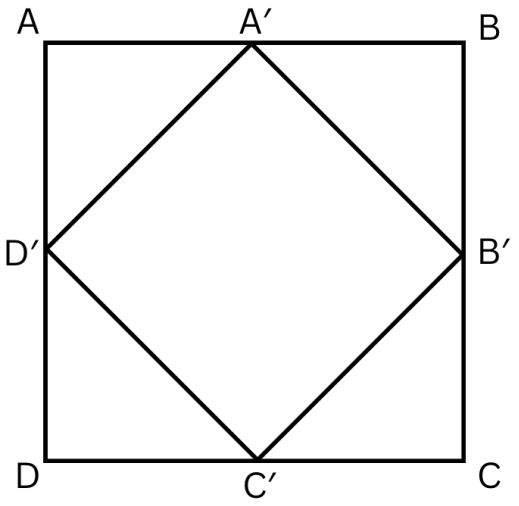
SJA MATHEMATICS CONTEST II

April 11, 2025

INTERMEDIATE INDIVIDUAL ROUND

1. A square $ABCD$ has a side length of 10. Another square $A'B'C'D'$ is drawn by connecting the midpoints of each side of the square $ABCD$, as shown. What is the difference between the area of $ABCD$ and area of $A'B'C'D'$?



(A) 16 **(B)** 25 **(C)** 50 **(D)** 75 **(E)** 100

2. Only one of the four digits of the number 2025 is odd. How many integers between 1000 and 9999, inclusive, have the property that only one digit is odd? (Digits do not need to be distinct)

(A) 1250 **(B)** 1765 **(C)** 1950 **(D)** 2125 **(E)** 2350

3. Hilly is invited to a video-call fan sign event. Hilly's favorite idol group has a total of 11 members and he has 2 biases: Billy and Rilly. However, he could only do a video call with 3 members. What is the probability of Hilly doing a video call with his two biases?

(A) $\frac{1}{165}$ **(B)** $\frac{3}{165}$ **(C)** $\frac{5}{165}$ **(D)** $\frac{7}{165}$ **(E)** $\frac{9}{165}$

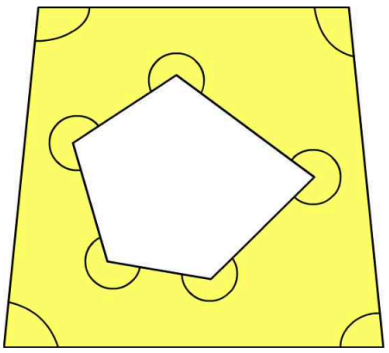
4. The point $A(\frac{10}{3}, a)$ is on the straight line $y = 3x$. The points B, C, and D are reflections about the x-axis, y-axis, and origin, respectively, of point A. Find the area of the triangle BCD.

(A) $\frac{100}{3}$ **(B)** $\frac{140}{3}$ **(C)** $\frac{200}{3}$ **(D)** $\frac{400}{3}$ **(E)** 200

5. Given $x = \frac{1}{n} - \frac{1}{n+1} + \frac{1}{n+1} - \frac{1}{n+2} + \frac{1}{n+2} - \frac{1}{n+3} + \ldots - \frac{1}{n+50}$, what is the value of x when $n = 5$?

(A) $\frac{1}{11}$ **(B)** $\frac{3}{32}$ **(C)** $\frac{3}{31}$ **(D)** $\frac{5}{33}$ **(E)** $\frac{2}{11}$

6. What is the sum of all 9 angles of the yellow polygon in the diagram?



(A) 540 **(B)** 1040 **(C)** 1440 **(D)** 1620 **(E)** 1800

7. In KISMC, Hilly earns 4 points for correct answers and loses 2 points for incorrect answers. There are a total of 15 questions, and if Hilly answered all the questions and received 36 as his score, what is the difference between the number of correct answers and the number of incorrect answers?

(A) 1 **(B)** 3 **(C)** 5 **(D)** 7 **(E)** 9

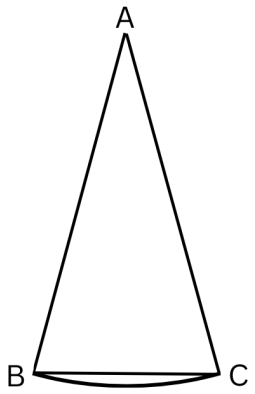
8. Three six-sided dice are rolled. The probability that the product of the three numbers is 24 is, in its simplest form, $\frac{a}{b}$. What is $a + b$?

(A) 77 **(B)** 110 **(C)** 178 **(D)** 223 **(E)** 227

9. What is the digit of the 2025th decimal place of the fraction $\frac{1}{7}$?

(A) 1 **(B)** 2 **(C)** 4 **(D)** 5 **(E)** 7

10. Triangle ABC is an isosceles triangle with $AB = AC$. Also, arc BC is part of a larger circle O, as shown. If $\angle BAC = 30°$ and $AB = 6$, what is the area between the circular arc BC and the triangleABC?



(A) $2\pi - 5$ **(B)** $3\pi - 9$ **(C)** $3\pi - 9\sqrt{3}$**(D)** $3\pi - 11$ **(E)** $4\pi - 9$

11. When three-digit natural numbers m and n make both $\sqrt{2m}$ and $\sqrt[3]{3n}$ integers, solve for a minimum of $m + n$.

(A) 279 **(B)** 293 **(C)** 339 **(D)** 358 **(E)** 371

12. In Hilly's high school, there are a total of 300 students. Out of those 300 students, 31% are varsity soccer players, 54 students are varsity volleyball players, and 9% are playing both. What is the probability of choosing a student who doesn't play any sports?

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

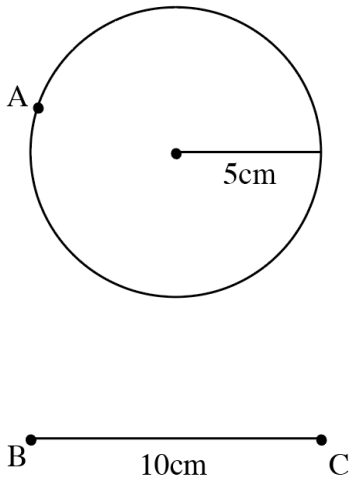
13. In Hilly's Math Contest, you have to choose to answer a total of 12 questions from Part A and Part B and you must answer at least 5 from each part. There are 7 questions in Part A and 9 questions in Part B. How many ways could the 12 questions be answered?

(A) 1470 **(B)** 1480 **(C)** 1490 **(D)** 1500 **(E)** 1510

14. Hilly is time-traveling. Hilly started time travel on Wednesday, October 23, 2024, and jumped 1000 days into the future. On what date will Hilly arrive? (1 year = 365 days)

(A) July 20 **(B)** June 30 **(C)** August 1 **(D)** July 22 **(E)** July 21

15. A circle in the diagram has a radius of 5 cm, and its center is 10 cm away from the line segment BC, which has a length of 10 cm. A point A on the circle is 11 cm away from the line segment BC. Starting from the given position in the diagram, point A moves clockwise around the circle at a constant speed of one full revolution every 2 minutes. The area of the triangle formed by connecting points A, B, and C is measured once every 15 seconds, for a total of 8 times. What is the total sum of 8 triangle ABC areas?



(A) 250 **(B)** 300 **(C)** 350 **(D)** 400 **(E)** 450