



2024 Spring Cup
Mathematical Olympiad
PRELIMINARY ROUND

Date: 28 January 2024

Time Given: 1 hour

Level: Primary 6

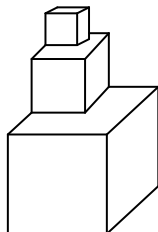
Name: _____

Instructions to Candidates

1. Do not open the booklet until you are told to do so.
2. Answer ALL 20 questions.
3. Write your answers in the answer sheet provided.
4. No steps are needed to justify your answers.
5. Questions 1-7 are worth 4 marks each.
6. Questions 8-14 are worth 6 marks each.
7. Questions 15-19 are worth 8 marks each.
8. Question 20 is worth 10 marks.
9. No marks will be deducted for wrong answers.
10. No marks will be given for unanswered questions.
11. No calculators or mathematical instruments are allowed.

Questions 1 to 7 are worth 4 marks each.

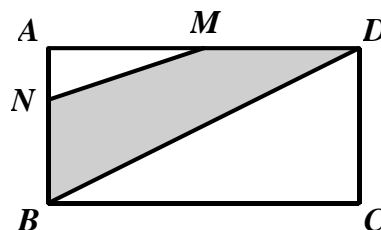
1. The diagram below represents the model is formed by gluing together three cubic blocks with side lengths of 1 meter, 2 meters, and 4 meters. If the bottom of the largest cube is not painted, what is the painted surface area of the model in square meters?



2. Mr. Zhou and Mr. Wang are taking a walk along the circular path in the school. Mr. Wang walks at a speed of 55 meters per minute, while Mr. Zhou walks at a speed of 65 meters per minute. The length of the path is 480 meters, and they start walking in opposite directions from the same point and at the same time. After their 10th encounter, if Mr. Wang wants to return to the starting point, how many more meters does he need to walk?

3. Two candles of the same thickness and material have a length ratio of 29:26. After burning for 50 minutes, the length ratio between the longer and shorter candles becomes 11:9. How many more minutes can the longer candle burn?

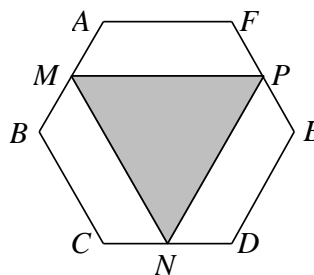
4. In the figure, the area of the rectangle is 1. M is the midpoint of AD , and $2AN = BN$. What is the area of the shaded region?"



5. If $\frac{1 \times 2 \times 3 \times \cdots \times 2024}{12^n}$ is a positive integer, the maximum value of n is _____.

6. Four little monkeys are eating peaches. The first monkey eats $\frac{1}{3}$ of the total eaten by the other three monkeys. The second monkey eats $\frac{1}{4}$ of the total eaten by the other three, and the third monkey eats $\frac{1}{5}$ of the total eaten by the other three. The fourth monkey finishes the remaining 69 peaches. How many peaches did the four monkeys eat in total?

7. The area of $ABCDEF$ is 2016 square centimeters. M is the midpoint of AB , N is the midpoint of CD , and P is the midpoint of EF . What is the area of triangle MNP in square centimeters?

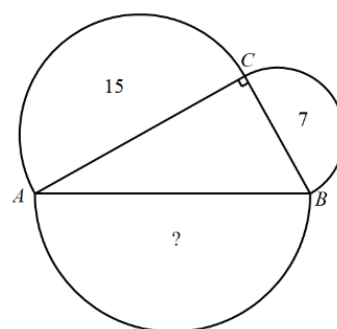


Questions 8 to 14 are worth 6 marks each.

8. Calculate $\frac{1}{4} + \frac{1}{4^2} + \frac{1}{4^3} + \frac{1}{4^4} + \frac{1}{4^5} + \frac{1}{4^6}$.

9. A certain seven-digit number is represented as $\overline{2abcdef}$, and its product with 3 is represented as $\overline{abcdef6}$. Find the value of \overline{abcdef} .

10. The following figure is obtained by drawing semicircles outward with the sides of the right-angled triangle ABC as diameters. The numbers inside the semicircles represent the area of each respective semicircle. Determine the area of the unknown semicircle



11. Alex and Ben depart from points A and B simultaneously, moving towards each other. At the start, their speeds are in the ratio of 3:2. After they meet, Alex's speed increases by 20%, and Ben's speed increases by $\frac{1}{3}$. When Alex reaches point B, Ben is still 41 kilometers away from point A. What is the distance between points A and B?

12. If the number $\overline{2023\underbrace{202620262026\cdots 2026}_{n \text{ "2026"s}}}$ is divisible by 33, what is the minimum value of n ?

13. What is the integer part of the value of $\frac{1}{\frac{1}{10} + \frac{1}{11} + \frac{1}{12} + \cdots + \frac{1}{19}}$

14. Distribute 31 peaches to several monkeys, and each monkey will receive no more than 3 peaches. So at least how many monkeys get the same number of peaches?

Questions 15 to 19 are worth 8 marks each.

15. A pile of pearls consists of 6468 beads. If a prime number of beads is taken each time, after several times, exactly all the beads are taken, and there are a total of a ways to do this. If an odd number of beads is taken each time, after several times, exactly all the beads are taken, and there are b different ways to do this. Find the value of $a + b$. (the number of beads taken each time is the same).

16. How many six-digit numbers have a digit sum of 45?

17. In the blank space, fill in the appropriate numbers to make the following vertical equation valid, and try to minimize the product. What is the minimum product?

$$\begin{array}{r} \square \square \square \square \\ \times \quad \quad \square 6 \\ \hline \square \square \square \square 4 \\ \square \square \square 0 \\ \hline \square \square \square \square \square \end{array}$$

18. What is the sum of all simplified proper fractions with a denominator of 2024?

19. A series of numbers a_1, a_2, \dots, a_n , $S(a_i)$ is represented by the sum of the digits of a_i . (For example, $S(22) = 2 + 2 = 4$.)

Given $a_1 = 2017$, $a_2 = 22$, and $a_n = S(a_{n-1}) + S(a_{n-2})$, (For example,

$a_3 = S(a_2) + S(a_1) = S(22) + S(2017) = 4 + 10 = 14$), then find the value of a_{2017} .

Question 20 is worth 10 marks.

20. In your opinion, from question 1 to 19, your favourite question is question _____ and the most difficult question is question _____.

(As long as your answer is within 1 to 19, you get full marks, otherwise you get zero.)