

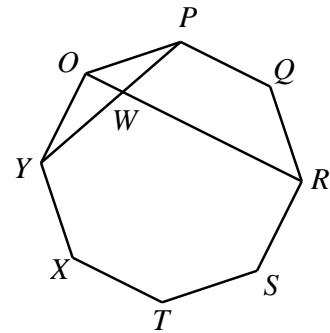
2023 SMOPS Round 1

(Special thanks to our students from the Spring class 2023 for providing the questions.)

1. A wonderful number is divisible by 49 and consists only of digits 4 and 9. 49 is the smallest wonderful number. What is the 2nd smallest wonderful number?
2. Find the sum of digits of $10^{23} - 20$.
3. What is the largest integer whose prime factors add up to 14.
4. Given that $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 1$ and a, b, c are positive integers, how many different values for $a + b + c$ are there?

5. What is the smallest possible number of dates for the second Tuesday after the second Friday in a month?
6. There is a glass of water. In the first step, $\frac{1}{2}$ of the water was poured out; in the second step, $\frac{1}{3}$ of remaining the remaining water was poured out; in the third step, $\frac{1}{4}$ of the remaining water was poured; in the fourth step, $\frac{1}{5}$ of the remaining water was poured out ... After which step will there be $\frac{1}{10}$ of the original amount of water left in the glass?
7. How many four-digit number \overline{ABCD} are there such that $A + B = C + D$ and $A + C = B + D$?
8. Mr Wong travels from A to B at a speed of 60km/h. He then travels from B to C without stopping at B at 45km/h. Given that $AB : BC = 2 : 1$. Find Mr Wong's average speed throughout the journey in km/h?

9. If $PQRSTXYO$ is a regular 8-sided polygon and $\angle PWR = x$, find the value of $4x$.



10. There are 27 $1 \times 1 \times 1$ cubes such that their six sides are labelled with 1 to 6 according to the following rule: The opposite side of 1 is 2, the opposite side of 3 is 4, the opposite side of 5 is 6. If these 27 $1 \times 1 \times 1$ cubes were stacked to form a $3 \times 3 \times 3$ cube and S is the sum of the numbers on the outer surface of the $3 \times 3 \times 3$ cube, what is the maximum value of S?

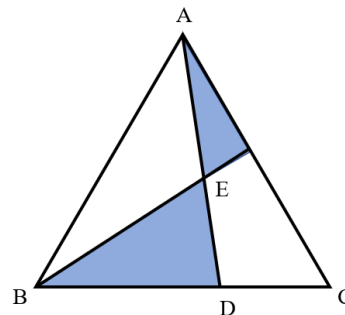
11. In the following table, the sum of any 3 adjacent cells is 2023, find x .

494							949				x
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12. An n -sided polygon has 5 times as many diagonals as sides. Find n . (For example, a square has 4 sides and 2 diagonals)

13. At a carnival, an adult ticket costs \$4 more than a child ticket. One day, they sold 100 more child tickets than adult tickets and made \$1475. How much would they have made that day if the prices of the child and adult tickets were swapped?
14. From 1 to 1000, how many numbers have 9 divisors?
15. All square numbers from 1 to 10000 are written in 1 line: 1491625...10000. How many digits are there?
16. In Oldcastle University, there are 900 students. Each student learns 6 subjects. Each teacher teaches 5 subjects. If every class consists of 30 students and 1 teacher, how many teachers are there?

17. As shown in the figure below, given that the area of $\triangle ABC = 64\text{cm}^2$, $2BD = 3DC$ and $AE = ED$, find the area of the shaded region.



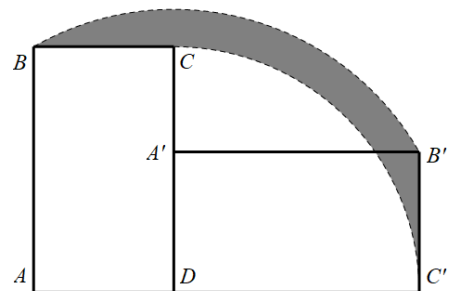
18. If the lowest common multiple of a, b, c is 2023 times of the highest common factor, what is the lowest sum of $a + b + c$?

19. Tom writes 11 consecutive numbers on a piece of paper. If he erases one of the numbers, the sum of the remaining numbers is 2023. Find the number that he erased.

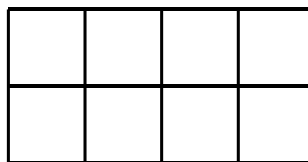
20. Given the sequence $\frac{1}{2}, \frac{1}{3}, \frac{2}{3}, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{1}{5}, \dots$. If the 2023rd number of this pattern is $\frac{a}{b}$, what is $a + b$?

21. 2023 is divisible by 7 and 2024 is divisible by 8. When will the year after 2023 be divisible by 7, and the next year is divisible by 8?

22. A rectangular $ABCD$ is rotated 90° clockwise around point C to position $CB'A'D'$. If $AB = 41\text{cm}$, $AD = 14\text{cm}$, find the area of swept by BC (shaded area).

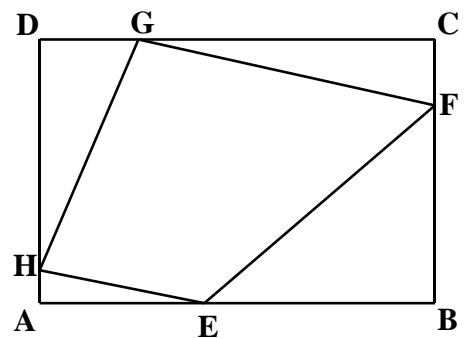


23. How many ways are there to colour the 2×4 grid below using 4 different colours such that each cell is coloured with only one colour and the colour of adjacent cells must be different.



24. 4 identical red balls and 4 identical blue balls are arranged in a straight line. How many arrangements are there if every 3 balls must have 2 different colours?

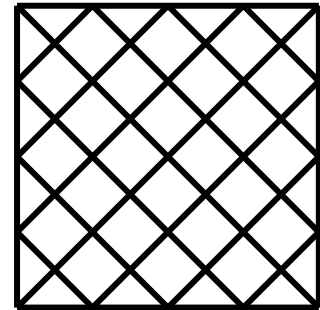
26. As shown in the figure below, given that $AB = 60$, $BC = 40$, H is 24cm lower than F , G is 10cm to the left of E , what is the area of the quadrilateral $EFGH$?



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- Diagram of a rectangular garden with a path. The garden is 108m long and 57m wide. A path 60cm wide is shown around the inner rectangle. The path is 60cm wide on the top and bottom, and 57m wide on the left and right.

28. A 5-digit number \overline{abcde} is called a “rollercoaster” number if it meets all the conditions:
 a, b, c, d, e are distinct numbers from 1 to 9.
 d is larger than its 2 neighbouring numbers.
 b is larger than its 2 neighbouring numbers.
 How many such “rollercoaster” numbers are there?

29. How many triangles are there in the following figure?



30. In the following figure, how many rectangles (including squares) are there where the sum is a multiple of 7?

43	44	45	46	47	48	49
36	37	38	39	40	41	42
29	30	31	32	33	34	35
22	23	24	25	26	27	28
15	16	17	18	19	20	21
8	9	10	11	12	13	14
1	2	3	4	5	6	7