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Mathlete Training Centre  
SMOPS 2024

**Round 1**

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1.  $X$  is a factor of 2024 and a multiple of 23. How many values of  $X$  are there?

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2. The price of an item is decreased by 5% and then increased by 40%. The new price is \$990 more than the original. What is the original price?

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3. There are 3 people,  $A$ ,  $B$  and  $C$ . They split \$1300 among themselves to invest.  $A$  and  $B$  together increased their money by 25% while  $C$  lost \$50. They had a total of \$1490 in the end. How much was  $C$  given at first?

4. There are 2000 cards in a deck numbered 1 to 2000 respectively. In one operation, all the cards with numbers that are perfect squares are removed. Then, all the remaining cards are renumbered 1, 2, 3, . . . . How many operations must be done until 1 card remains?

5. If 8 identical dice are rolled at the same time, how many possible combinations of rolls are there? (Note that order does not matter)

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6. When a number is divided by 100, the quotient is  $q$  and the remainder is  $r$ . If the sum of  $q$  and  $r$  is a multiple of 11, how many 4 digit numbers satisfy this?

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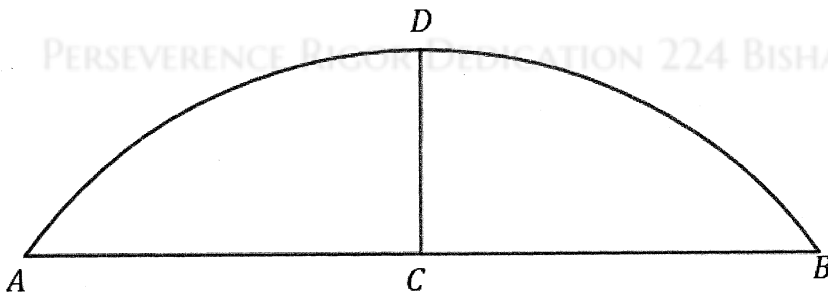
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7.  $p$  and  $q$  are prime numbers. If  $3p^2q + 2pq^2 = 483$ , what is the maximum value of  $p + q$ ?

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8. In a circle,  $\text{arc}AD = \text{arc}DB$ ,  $AC = CB = 5$  and  $CD = 1$ , what is the value of the diameter?



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9. From 1 to 2024, how many numbers are there where the sum of its digits equal to 10?

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10. If the mean of  $a, b$  and  $c$  is 100, the mean of  $a, b, c, d$  and  $e$  is 90 and  $e = 4d$ , what is the value of  $e$ ?

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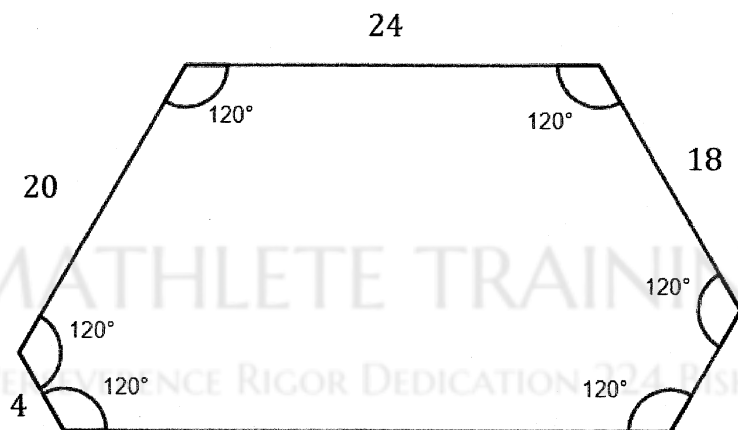
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11. The 3 sides of a triangle are integers, and its perimeter is 15. How many combinations of such triangles are there?

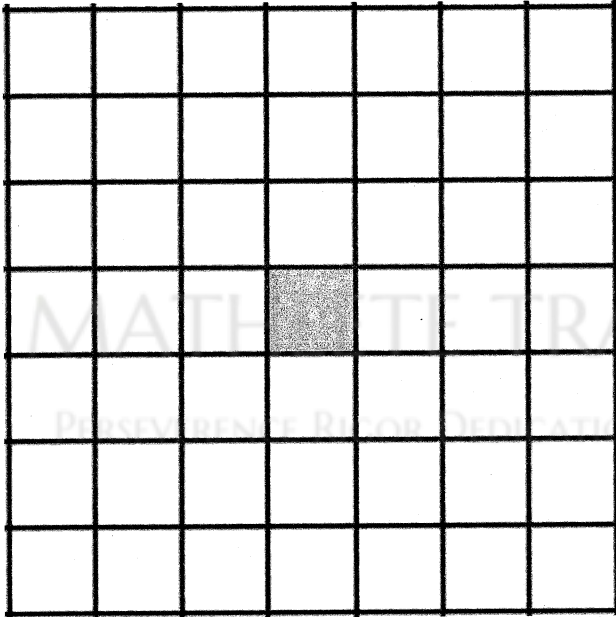
12.  $\overline{SMOPS} + \overline{APMOPS} = 808182$ , what is the value of  $A + P + M + O + S$ ?

13. What is the perimeter of the following shape?

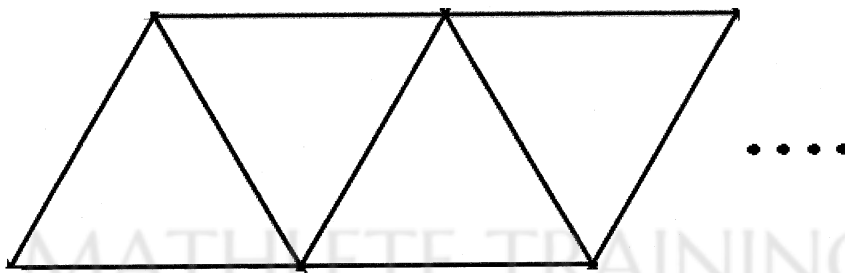


14. 2 farmers sold a total of 400 eggs. They sold for different prices. The first farmer said to the second farmer: "If I had the amount of eggs you had, I would have made \$270." The second farmer said to the first farmer: "If I had the amount of eggs you had, I would have made \$120. If they made the same amount of money, how many eggs does the first farmer have?"

15. How many rectangles contains the shaded square and has an even area?



16. There are 51 sticks in the figure pattern. How many triangles are there?





17. If the length and width of a rectangle both increases by 5cm, its area increases by  $200\text{cm}^2$ . What is its perimeter?

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18. The sum of the interior angles of an  $n$ -sided figure is smaller than  $2024^\circ$ . What is the maximum value of  $n$ ?

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19. How many integer values of  $n$  are there such that  $\frac{n}{40-n}$  is a perfect square?

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20. During CNY, Mr Lee sets up a stack of oranges in a pyramid-like formation whose square base is made of 49 oranges (7 by 7). Each orange above the first level rests in the pocket formed by 4 oranges in the level below. The stack is completed by a single orange in the 7<sup>th</sup> level. How many oranges are there in the stack?

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21. 30 identical small cubes are placed together to form a rectangular solid. Find the total number of different rectangular solids that can be formed this way.

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22. A circus has an acrobatic bicycle with front and rear wheels of different sizes. The diameter of the front wheel is 140cm and the diameter of the back wheel is 90cm. How many centimeters did the bike move when the rear wheel made 10 more revolutions than the front wheel? (Take  $\pi = \frac{22}{7}$ )

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23. Let  $a, b$  and  $c$  be 3 distinct positive integers whose product is equal to 2024. What is the smallest value of the sum  $a + b + c$ ?

24. Two travellers' bags have a total weight of 77kg. The first traveller pays \$14 for extra weight while the second pays \$20 for extra weight. If both are checked in together, they pay \$94. What is the maximum bag weight?

25. One person wants to buy 4 donuts from a shop with sufficient supply of 3 flavours of donuts: original, chocolate and strawberry. How many possible combinations are there?

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26. What is the maximum number  $x$  such that if you roll a dice, the product of the 5 faces showing is always a multiple of  $x$ ?

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27. The 49<sup>th</sup> day of year  $X$  is Monday.  
The 94<sup>th</sup> day of year  $X + 1$  is Saturday.  
What is the first day of year  $X - 1$ ?

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28.  $n$  is a positive integer that satisfies  $n(n + 1)(n + 2) = 2024m$ . What is the smallest value of  $m$ ?

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29. The number  $P$  is the product of all the divisors of 2024. How many digits does  $P$  have?

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30. How many 4-digit numbers are there with at least two digit '2's and one digit '4'?

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