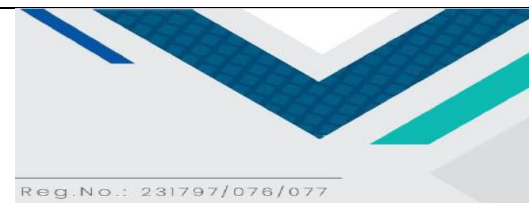




**District Level Mathematical Olympiad**  
**[DMO]-2022/23**  
**For- IMO\_2023 [Japan]**



Reg.No.: 231797/076/077

**SET – I**

[www.mannepal.org.np](http://www.mannepal.org.np)

1. Kevin is a runner training for a marathon. At the end of each week, he calculates the total number of miles he ran that week. Kevin plans to increase the total number of miles he runs each week by five miles. This week Kevin runs the following number of miles each day: 3,0,5,4,2,6,7. How many miles does Kevin plan to run next week?  
a. 27                      b. 32                      c. 37                      d. 42
2. What is the least possible positive integer value of  $n$  such that  $\sqrt{18 \cdot n \cdot 34}$  is an integer?  
a. 9                      b. 68                      c. 17                      d. 34
3. The graph of  $y = ax^2 + bx + c$  passes through the points (0, 5), (1, 10) and (2, 19). Find  $a^a + b^b + c^c$  ?  
a. 3138                      b. 3150                      c. 3155                      d. 3156
4. Determine the unit digit of  $17^{13} - 17$ .  
a. 7                      b. 1                      c. 0                      d. 3
5. The product of integers 240 and  $k$  is a perfect cube. What is the smallest possible positive value of  $k$ ?  
a. 800                      b. 900                      c. 1000                      d. 7200
6. Two dice are thrown. What is the probability that the product of the two number is multiple of 5?  
a.  $\frac{1}{36}$                       b.  $\frac{1}{18}$                       c.  $\frac{1}{6}$                       d.  $\frac{11}{36}$
7. When  $1999^{2000}$  is divided by 5, the remainder is?  
a. 1                      b. 2                      c. 3                      d. 4
8. The number  $N$  is between 9 and 17. The average of 6, 10, and  $N$  could be  
a. 6                      b. 15                      c. 12                      d. 10
9. Bag A has 3 chips labeled 1, 3, and 5. Bag B has three chips labeled 2, 4, and 6. If one chip is drawn from each bag, how many different values are possible for the sum of the two numbers on the chips?  
a. 5                      b. 7                      c. 8                      d. 9
10. Pick two consecutive positive integers whose sum is less than 100. Square both of those integers and then find the difference of the squares. Which of the following could be the difference?  
a. 64                      b. 79                      c. 103                      d. 131
11. Let  $a$ ,  $b$  and  $c$  be numbers with  $0 < a < b < c$ . Which of the following is impossible?  
a.  $a \times b < c$                       b.  $a + b < c$                       c.  $a \times c < b$                       d.  $a + c < b$
12. In a triangle  $ABC$ , we have  $AC = BC = 7$  and  $AB = 2$ . Suppose that  $D$  is a point on line  $AB$  such that  $B$  lies between  $A$  and  $D$  and  $CD = 8$ . What is  $BD$ ?  
a. 3                      b.  $2\sqrt{3}$                       c.  $4\sqrt{2}$                       d. 4

13. Consider the following quotients: A) 368.39 divided by 17 B) 170.50 divided by 62 C) 875.65 divided by 83 their correct sequence in decrease order is:  
a. A, C, B    b. B, A, C    c. B, C, A    d. C, A, B
14. Given that  $(x^2 - x - 5)^{(x^2-1)} = 1$  have  $n$  solutions, then  $n$  is  
a. 2    b. 3    c. 4    d. 5
15. The range of  $y = \sqrt{32 - 4x - x^2}$  is which of the following:  
a.  $[0,6]$     b.  $[-6,6]$     c.  $(-\infty, \infty)$     d.  $[0, \infty)$
16. In a transaction, the profit percentage is 80% of the cost. If the cost further increased by 20% but the selling price remains the same, how much is the decrease in profit percentage?  
a. 40    b. 50    c. 30    d. 20
17. The six digit number 54321A is divisible by 9 where A is a single digit whole number. Find A  
a. 9    b. 1    c. 3    d. 0
18. In the beginning, Ram works at a rate such that he can finish a piece of work in 24 hrs, but he only works at this rate for 16 hrs. After that, he works at a rate such that he can do the whole work in 18 hrs. How many hrs will he take to finish this work?  
a. 18    b. 19    c. 21    d. 22
19. Cities A, B, C are equidistance from each other. A motorist travels from A to B at 30 km/hrs. from B to C at 40km/hrs. and from C to A at 50 km/hrs. Determine his approximate average speed for his entire trip.  
a. 35    b. 38    c. 40    d. 42

20. If  $|x - 2| = p$ , where  $x < 2$ , then  $x - p$  is equal to  
a. 2    b.  $2-2p$     c. both    d. neither
21. The mean mark obtained by 150 students in a class is 60. The mean mark of boys is 70 and that of girls is 55. Find the number of boys and girls in the class are?  
a. B= 50, G=100    b. B=60, G =90  
c. B= 40, G=110    d. B=100, G= 50.
22. order of BA is which of the following:  
a.  $2 \times 7$     b.  $7 \times 2$     c.  $8 \times 3$     d.  $3 \times 8$
23. Dwayne planted 70 acres with two types of beans: navy and pinto. Each acre of navy beans yielded 27 bushels and each acre of pinto beans yielded 36 bushels. If Dwayne grew twice as many bushels of pinto beans as navy beans. How many acres of pinto beans did he plant?  
a. 30    b. 35    c. 40    d. 42
24. Brenda walked a 12 mile scenic loop in 3 hours. If she then reduced her walking speed by half. How many hours would it take Brenda to walk the same scenic loop two more times?  
a. 6    b. 8    c. 12    d. 18
25. Carlos runs a lap around the track in  $x$  seconds. His second lap is five second slower than the first lap, but the third lap is two second faster than the first lap. What is Carlos's average (Arithmetic mean) number of minutes per lap, in term of  $x$ ?  
a.  $x-1$     b.  $\frac{x-1}{60}$     c.  $\frac{x+1}{60}$     d.  $\frac{x+3}{60}$

26. A zoo has twice as many zebras as lions and four times as many monkeys as zebras. Which of the following could be the total number of Zebras, lions and monkeys at the zoo?  
a. 14      b. 28      c. 121      d. 129
27. Three people have \$32, \$72 and \$98 respectively. If they pool their money then redistribute it among themselves, what is the maximum possible value for the median amount of money?  
a. 85      b. 101      c. 105      d. 110
28. If  $x$  is 0.5% of  $y$ , then  $y$  is what percent of  $x$ ?  
a. 199      b. 200      c. 2000      d. 20000
29. How many integers between 2000 and 3999 have a unit digit that is a prime number?  
a. 400      b. 600      c. 800      d. 1000
30. A batch of widgets costs  $p+15$  dollars for a company to produce and each batch sells for  $p(9-p)$  dollars. For which of the following value of  $p$  does the company make a profit?  
a. 7      b. 6      c. 5      d. 4
31. For integer  $n \geq 3$ , a sequence is defined as  $a_n = (a_{n-1})^2 - (a_{n-2})^2$  and  $a_n > 0$  for all positive integers. The first term is  $a_1 = 2$  and the fourth term is equal to the first term multiplied by the sum of the second and third term. What is the third term  $a_3$ ?  
a. 0      b. 3      c. 5      d. 10.
32. If  $\frac{1}{2}f(x) = f\left(\frac{x}{2}\right)$ , which of the following is true for all values of  $f(x)$ ?  
a.  $2x+2$       b.  $13x$       c.  $x^2$       d.  $x-10$ .
33. A number that is 50% greater than 60 is what percentage less than the number that is 20% less than 150?  
a. 15      b. 25      c. 28      d. 30
34. If  $x$  is the number such that  $0 < x \leq 20$ , for how many values of  $x$  is  $\frac{20}{x}$  an integer?  
a. 6      b. 8      c. 10      d. more than 10
35. If  $x$  is odd, all except, which one of the following must be odd?  
a.  $x^2 + 4x + 6$       c.  $x^3 + 5x + 3$   
b.  $x^4 + 6x + 7$       d.  $x^5 + 7x + 1$
36. If  $a - \frac{1}{a} = b$ ,  $b - \frac{1}{b} = c$  and  $c - \frac{1}{c} = a$  then the value of  $\frac{1}{ab} + \frac{1}{bc} + \frac{1}{ca}$  is  
a. 0      b. -1      c. -2      d. -3
37. The function  $f: \mathbb{R} \rightarrow \mathbb{R}$  defined by  $f(x) = x^2$  is  
a. Injective      b. Surjective      c. Bijective      d. Neither
38. The quantities  $S$  and  $T$  are positive and are related by the equation  $S = \frac{K}{T}$ , where  $K$  is a constant. If the value of  $S$  increased by 50%, then the value of  $T$  decreases by what percent?  
a. 25      b.  $33\frac{1}{3}$       c. 50      d.  $66\frac{2}{3}$
39. If  $c$  and  $d$  are positive integers and  $m$  is the greatest common factor of  $c$  and  $d$ , then  $m$  must be the greatest common factor of  $c$  and which of the following integers?  
a.  $c+d$       b.  $2+d$       c.  $2d$       d.  $d^2$

40. If  $x$  and  $y$  are the hundreds digits and the tens digits, respectively of the product  $(725278 \times 67066)$  what is the value of  $(x+y)$  ?  
 a. 12      b. 10      c. 7      d. 5
41. If  $j$  and  $k$  are integers and  $j-k$  is even, which of the following must be even?  
 a.  $jk$       b.  $j+2k$       c.  $jk+j$       d.  $jk-2j$
42. In state X, all vehicle license plates have 2 letters from 26 letters of alphabet followed by 3 one digit numbers. How many different license plates can state X have if repetition of letters and number is allowed?  
 a. 67600      b. 608400      c. 676000      d. 60840
43. Define a function  $f(x) = |2x| + 4$  for all numbers  $x$ . For which of the following function  $g$ , defined for all numbers  $x$ , does the graph of  $g$  intersect graph of  $f$  ?  
 a.  $x - 2$       b.  $x + 3$       c.  $2x + 3$       d.  $3x - 2$
44. If  $x - 2y = 3$  and  $x^2 - 4xy = 5$ , what is the maximum possible value of  $x$ ?  
 a. 1      b. 3      c. 5      d. 7
45. When  $x$  is divided by 3, the remainder is 1, when  $x$  is divided by 7, the remainder is 2. How many positive integers less than 100 could be value of  $x$ ?  
 a. 7      b. 6      c. 5      d. 4
46. Given, ABCD is a rectangle. Points P, Q, R, S and T cut side AB of the rectangle such that  $AD=9$ ,  $AB=15$ ,  $AP=3$ ,  $PQ=QR=RS=ST=1$ . E is a point on AD such that  $AE=3$ . Which of the following segments is parallel to the diagonal BD of the rectangle?  
 a. EQ      b. ER      c. ES      d. ET
47. A 2-foot by 2-foot by 2-foot solid cube is cut into 2-inch by 2-inch by 4-inch rectangular solids, what is the ratio of the total surface area of all the resulting smaller rectangular solids to the surface area of the original cube? (1foot=12 inches)  
 a. 8:1      b. 10:1      c. 15:1      d. 5:1
48. Let X be a data set such that standard deviation of X=5. Then, the standard deviation of  $\frac{3X+6}{3}$  is  
 a. 7      b. 5      c. 0      d. 15
49. If P is a perimeter of a triangle with one side of 7 and another side of 9, what is the range of possible values for P?  
 a.  $2 < P < 16$       b.  $3 < P < 17$   
 c.  $18 < P < 32$       d.  $18 < P < 33$
50. The equation of the image of the line  $x + 3y = 9$  under the reflection by x-axis is?  
 a.  $-x + 3y = 9$       c.  $x - 3y = 9$   
 b.  $x + 3y + 9 = 0$       d.  $2x + 3y = 6$

GOOD LUCK !!!!