

## All Girls Math Nurture Camp - 2023

### Entrance Test

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# Instructions

- The time duration for the below qualifying test is 120 minutes from 10:00 am to 12:00 pm (IST) on November 26, 2023.
- Answers have to be submitted on the Google form: <https://tinyurl.com/agmnc23ans>
- You cannot submit the Google form more than once.
- No other form of submission will be accepted.
- Beyond 12:00 pm, the form will be deactivated. There is no option to save your answers in the Google form.
- Hence it is suggested that you write your answers on a sheet of paper, start filling up your answers in the Google form and then submit it. (Before 12:00 pm)
- Wherever there is a field/box to write the answer, write ONLY the INTEGER part of the answer. E.g. If the answer is 134 hours or 134 sq cm, write (fill) the answer as: 134 only. Do not use any full stop or any other explanation along with the answer. Any such content will fetch you a wrong answer because the checking is automated and not manual.
- Participants are not allowed to use any device for calculations or any sort of help from anyone else. Any such act will disqualify the application.
- Write down your rough calculations and email it to us using your registered email address as a single PDF to [ramfoundationinfo@gmail.com](mailto:ramfoundationinfo@gmail.com)
- Ensure that you have filled respective fields about your personal details correctly in the Google form.
- There are 3 groups in this test.
- Group A contains 7 problems, all are compulsory.
- Group B contains 6 problems, all are compulsory.
- Group C contains 7 problems, all are compulsory.
- There is no negative marking.

# Group - A

Each question carries 1 mark

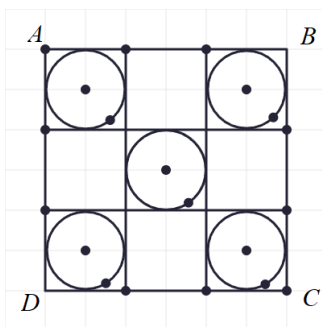
1.  $4x7y8$  is a five digit number divisible by 9. The number of ordered pairs  $(x, y)$  satisfying this is \_\_\_\_\_.
2. Consider the series  $1 - 3 + 7 - 9 + 13 - \dots$  where the  $(2n)^{th}$  term is  $-3(2n - 1)$  and  $(2n + 1)^{th}$  term is  $(6n + 1)$ . What is the sum of first 2023 terms?
3. Let  $\triangle ABC$  be an isosceles triangle in which  $\angle B = \angle C = 78^\circ$ . D and E are points on  $AB$  and  $AC$  such that  $\angle BCD = 24^\circ$  and  $\angle CBE = 51^\circ$ . Find  $\angle BED$ .

4. If

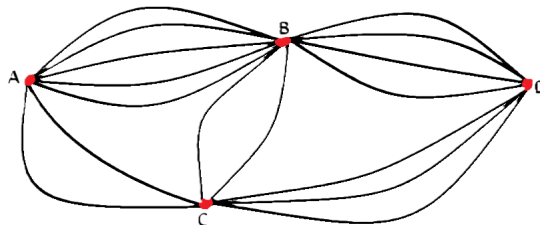
$$f(x, y, z) = \frac{xyz}{x + y + z}$$

If  $f(\frac{1}{2}, \frac{2}{3}, \frac{5}{6}) = \frac{m}{n}$  where  $m, n$  have no common factor other than 1. Find  $m + n$ .

5. In the image below, a large square  $ABCD$  is divided into 9 equal parts and circles are inscribed in five of the smaller squares. Area of all 5 circles is  $45\pi$  square units. Find the area of the square  $ABCD$ .



6. In a small city, there are 4 hospitals:  $A, B, C$  and  $D$ . There are 5 roads between  $A$  and  $B$ , 4 roads between  $B$  and  $D$ , 2 roads between  $A$  and  $C$ , 3 roads between  $C$  and  $D$  and 2 roads between  $B$  and  $C$ . How many possible different ways are there to travel from  $A$  to  $D$  through  $B$  or  $C$  or both  $B$  and  $C$ ? [Note: You can visit  $A, B, C, D$  each at the most once on each path.]



7. What is the largest 3-digit divisor of the number 4845?

# Group - B

Each question carries 2 marks

1. The sum of the digits of the number

$$10^n - 10^{n-1} - 10^{n-2} - \dots - 10 - 2$$

is 2856, find  $n$ .

2. In a classroom there were  $X$  number of boys and  $Y$  number of girls. If 20 girls left, then the ratio of the number of girls to the number of boys is 1:3. If later, 36 boys left then the boys and girls are equal in number. Find  $Y$ .
3. In a passenger train where every seat bears a seat number from 1 to 72 where both 1 and 72 are window seats. There are equal number of seats on either side of the aisle (aisle is the walkway). The seats are numbered in a right-to-left in a sequence where 1 is the right-most seat and hence a window-seat. There are three types of seats - Window Seat (W) which is close to a window, Aisle Seat (A) which is close to the aisle and Middle Seat (the seat which is neither a window nor an aisle seat). If 58 is an A, 38 is M and 31 is W, what kind of a seat will be seat number 49?
- a. W                      b. M                      c. A  
d. Cannot be determined as multiple solutions are possible.

4. Find  $x$  such that,

$$2^{2^{3^{2^2}}} = 4^{4^x}$$

5. Jitesh and Hiloni came to a large round field surrounded by a ring of bamboo trees and decided to count the trees. Jitesh walked around the field and counted all the trees. Hiloni did the same, but started from a different tree. Jitesh's 20<sup>th</sup> was Hiloni's 7<sup>th</sup>, while Jitesh's 7<sup>th</sup> tree was Hiloni's 94<sup>th</sup>. How many trees were growing around the field? [Note: Both are moving in the same direction.]
6. 100 students were learning a classical dance form in a hall. They had left their shoes outside the hall. When they came out of the hall, there was a power shut down and with no source of light it was pitch dark outside. They started walking slowly out of the hall one by one and put on shoes randomly. If any pair of shoes is big enough for their feet, they would wear it. If that was not the case they wouldn't wear any shoes at all. What is the largest number of students who might have had to go without a pair of shoes? [Note: No student can try more than one pair of shoes.]

# Group - C

Each question carries 3 marks

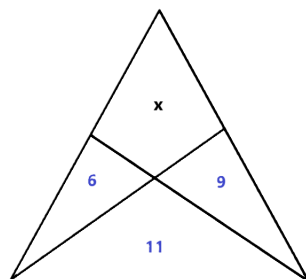
1. For any  $x$ ,

$$|x| = \begin{cases} -x & \text{if } x < 0 \\ 0 & \text{if } x = 0 \\ x & \text{if } x > 0 \end{cases}$$

Find the number of solutions of the equation

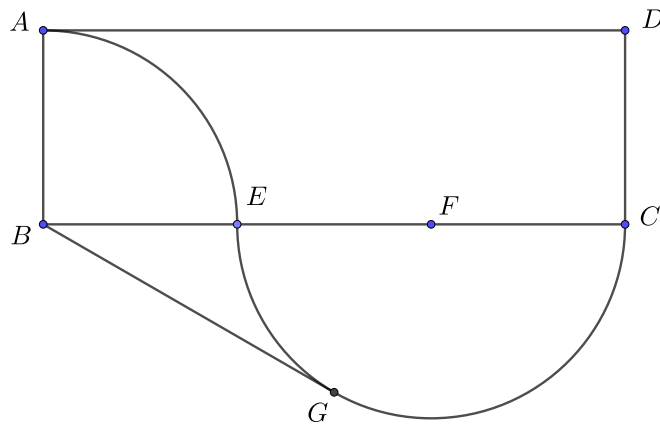
$$x^2 + 2|x| + 1 = 0$$

2. Five children had certain amount of money with them such that amount that each one had was different from the others. Let us call the child with maximum amount 'Max' and the one with the least as 'Min'. The ratio of the amounts of any child with the amounts of any child who has lesser money, was always an integer. The combined total of everyone's amounts was 847 rupees. Find the amount that Min had.
3. The number of three-digit positive integers which will leave a remainder 3 when they divide 2023 is \_\_\_\_\_
4. In the figure below, triangle is divided into 4 regions. The areas of triangles are  $x, 6, 9, 11$  as shown in the figure. Find the value of  $67x$ .



5. Angad and Kishan were traveling in an airplane. There were a total of 10 rows in the airplane, each having 6 seats. The airline decides to randomly allocate seats to all 60 passengers. If the probability of Angad and Kishan getting adjacent seats is  $\frac{a}{b}$ , where  $a$  and  $b$  are coprime, what is the value of  $b - a$ ?  
 [Note: In any row, the seats  $C$  and  $D$  are separated by a pathway but we will consider  $C$  and  $D$  as adjacent seats.]
6. A 7-digit number is such that sum of any 4 consecutive digits is 20 and sum of any 5 consecutive digits is 26. Find the 7-digit number.

7. If  $BG$  is the tangent to the semicircle on  $CE$  and the length of  $BG$  is 6, what is half of the area of the rectangle  $ABCD$ ?



— End of the paper —