MBMT Team Round — Brahmagupta

April 16, 2023

DO NOT BEGIN UNTIL YOU ARE INSTRUCTED TO DO SO.

This round consists of **15** questions. You will have **45** minutes to complete the round. Later questions are worth more points; point values are notated next to the problem statement. (There are a total of 100 points.) Please write your answers in the simplest possible form.

DO NOT TURN THE QUESTION SHEET IN!
Use the official answer sheet.

You are highly encouraged to work with your teammates on the problems in order to solve them.

MBMT Team Round Answer Sheet — Brahmagupta

April 16, 2023

Team Name _____

Team Number _____

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1 **[4]** Evan calculates the mean of the set 60, 63, 68, 71, 73. However, he mistakenly puts 70 into his calculator instead of 60. What is the absolute difference between the mean of the set and the incorrect mean Evan calculates?

2 **[4]** A regular pentagon (5 sides) and a regular nonagon (9 sides) have the same perimeter. If the side length of the pentagon is 18, what is the side length of the nonagon?

3 **[4]** Ada is collecting pesetas at a rate of 5 per minute. If Ada started out with a certain amount of pesetas, and after 18 minutes, she has quadrupled the amount of pesetas she has, how many pesetas does Ada have after one hour?

4 **[5]** Anne wants to crochet a rectangular blanket with 36 square meters of yarn. If the side lengths of her blanket must be positive integers and she uses up all of her yarn in the process - how many different widths can her blanket have?

5 **[5]** Timmy is playing a game where he is given an integer x amount of money between 1 and 100 inclusive, but then has a $x\%$ chance of losing the money. What amount of money should Timmy choose to maximize his profit?

6 **[5]** How many 2-digit primes have digits summing to a prime?

7 **[6]** Paula has a regular hexagon with a side length of 3. She draws an outward-facing equilateral triangle on each side and connects the outer vertices to create a larger hexagon. What is the side length of the larger hexagon?

8 **[6]** If $x^2 + y^2 - 6x - 2y + 10 = 0$, find $3x + 2y$.

9 **[7]** How many 4-digit integers have digits multiplying to 24?

10 **[8]** In right triangle $\triangle$ ABC, angle C is 90 degrees and AC = 10. If angle A is between 45 and 60 degrees, exclusive, how many integer values could side length BC possibly be?

11 **[8]** The circle $(x-5)^2+(y-3)^2=16$ is tangent to the line $y=x+b$. Find the sum of all possible values of b.

12 **[9]** What is the number of 9-move paths from (0, 0) to (3, 4) where each move has length 1 and can be up, left, down, or right?

13 **[9]** How many lattice points lie on the interior of the figure described by the equation $(|2x|+|3y|-12)^2<36$?

14 **[10]** Find the smallest positive integer k such that $k\cdot(2^2-1)(3^2-1)(4^2-1)...(2024^2-1)$ is a perfect square.

15 **[10]** Define an operation $x \,\&\, y = x+y^2$. What is $((...(((1 \,\&\, 3) \,\&\, 5) \,\&\, ...) \,\&\, 19)$?