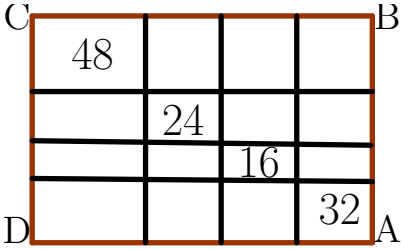
Bhaskaracharya Pratishthana, Pune
Bhaskaracharya Mathematics Talent Search Competition
2022-2023
Round 2

Time: 11 am to 1. 30 pm Max. Marks: 60
Sunday - 08/01/2023

Detail solutions of all questions in the paper should be written.

Q1) Solve each of the following questions. [32 marks]
All questions carry equal marks.

1. Rectangle ABCD is divided into rectangular parts as shown in the figure. If the numbers written in the 4 small parts indicate respective perimeters of those rectangles, find the perimeter of rectangle ABCD.



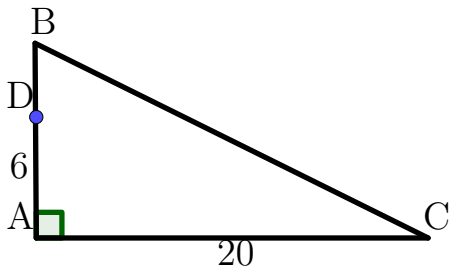
2. How many ordered pairs of positive integers (m, n) satisfy the equation: $\frac{m}{6} = \frac{6}{n}$.
Note that the ordered pair (2, 3) and (3, 2) are treated as different.

3. At a restaurant downtown, Mr. Red, Mr. Blue, and Mr. White meet for lunch. Under their coats they are wearing either a red, blue, or white shirt. Mr. Blue says,"Hey, did you notice we are all wearing different coloured shirts from our names?" The man wearing the white shirt says,"Wow, Mr. Blue, that's right!" Tell by explaining who is wearing what color shirt. Note that no two persons are wearing a shirt of the same colour.

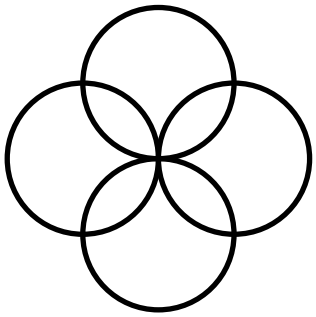
4. Find the value of $\sqrt{4\sqrt{9\sqrt{9\sqrt{9\sqrt{9\cdots}}}}}$

5. The product of a 3 digit number and the number obtained by reversing its digits is 83187. Find all such 3 digit numbers.

6. In triangle ABC, angle A is a right angle. Point D is on AB such that length of $AD = 6$ and $AC = 20, DB + BC = AD + AC$. Find length of DB. (Hint 1: $(x + y)^2 = x^2 + 2xy + y^2$). (Hint 2: In a right-angled triangle, the square of the hypotenuse side is equal to the sum of squares of the other two sides.)



7. Four runners are running on four circular tracks of 2 km each, as shown in the figure. They start at the exact same time from the point of intersection of four tracks and run on different tracks. They run at speeds of 4 km per hour, 6 km per hour, 8 km per hour and 10 km per hour respectively. They decided to run till they all simultaneously meet 3 times. For how much time did they run?



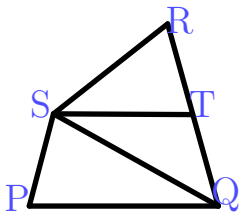
8. The L.C.M. of two natural numbers is 640 and the product of those two numbers is 10240. Find all possible pairs of such numbers.

Q2) Solve each of the following questions. [28 marks]
All questions carry equal marks.

9. Form the greatest seven-digit number, using ONLY the digits 1, 3, 5, 7, 9 each at least once, such that the number would be divisible by 9 and 5 both.

10. An iterative average of the numbers $1, 2, 3, 4$, and 5 is computed in the following way. Arrange the five numbers in some order. Find the mean of the first two numbers, then find the mean of that with the third number, then the mean of that with the fourth number, and finally the mean of that with the fifth number. What is the difference between the largest and smallest possible values that can be obtained using this procedure?

11. In $\square PQRS$, $PQ = QS = RS$. Point T is on side QR such that $ST \| PQ$, and $QT = ST = RT$. Find the measure of the following angles. $\angle RST$, $\angle QST$,$\angle SRT$, $\angle SQT$, $\angle RTS$, $\angle SQP$ and $\angle QPS$.



12. Consider the red central square in an array of unit squares, part of which is shown below. The first ring coloured yellow around the red central square has 8 unit squares. The second ring coloured green has 16 unit squares. The third ring is coloured red. We continue this pattern of colouring the squares with red, yellow and green colour in the same order. How many green coloured unit squares are there in the 51×51 big square?