



IMONST 2 2022 (JUNIOR)

READ THESE INSTRUCTIONS CAREFULLY:

1. **Time: 4 hours** (10.00 am to 2.00 pm, Saturday 30 July 2022).
2. The paper contains **six (6) problems**. Make sure you have the paper for the correct category. Each problem is worth 7 points.
3. You need:
 - (a) Internet access to download the question and submit your solution (not allowed during the contest period).
 - (b) A4 papers, pen, pencil, eraser, compass, ruler.
 - (c) A scanner or phone scanner app (e.g., Adobe Scan) to scan your solution.

Not allowed: Calculators, electronic/internet devices, books, printed materials.

4. Write the solution **by hand**. Do not use a computer.
5. Write your **full name, category, and school name** on **top of the first page**.
6. Work on your own. Any evidence of cheating will result in disqualification and ban from future IMONST events.
7. After the contest, scan your solution and save it as **one PDF file**, with filename:
(**Category**)\space(**Full name**) Example: (Primary) Muhammad Zafree Zaharidan.
8. Upload your solution at this link **before 2.30pm**:

<https://tinyurl.com/imonst2sub>

Late submission will be rejected.

GOOD LUCK

IMONST 2 2022 (Junior)

Problem 1. Given a circle and a quadrilateral $ABCD$ whose vertices all lie on the circle.

Let R be the midpoint of arc AB . The line RC meets line AB at point S , and the line RD meets line AB at point T .

Prove that $CDTS$ is a cyclic quadrilateral.

Diberi suatu bulatan dan suatu sisiempat $ABCD$ dengan kesemua bucuanya terletak pada bulatan tersebut. Andaikan R titik tengah bagi lengkok AB . Garis RC bersilang dengan garis AB pada titik S , dan garis RD bersilang dengan garis AB pada titik T .

Buktikan bahawa $CDTS$ adalah suatu sisiempat kitaran.

Problem 2. Without using a calculator, determine which number is greater: 17^{24} or 31^{19} .

Tanpa kalkulator, tentukan nombor mana yang lebih besar: 17^{24} atau 31^{19} .

Problem 3. Given an integer n . We rearrange the digits of n to get another number m .

Prove that it is impossible to get $m + n = 999999999$.

Diberi suatu integer n . Kita mengubah kedudukan digit-digit bagi n untuk memperoleh suatu nombor m .

Buktikan bahawa adalah mustahil untuk memperoleh $m + n = 999999999$.

Problem 4. Given a circle Γ with center I , and a triangle ABC with all its sides tangent to Γ . A line ℓ is drawn such that it bisects both the area and the perimeter of triangle ABC .

Prove that line ℓ passes through I .

Diberi suatu bulatan Γ dengan pusat I , dan suatu segi tiga ABC dengan semua sisinya tangen kepada Γ . Suatu garis ℓ dilukis supaya ia membahagi dua sama kedua-dua luas dan perimeter bagi segitiga ABC .

Buktikan bahawa garis ℓ melalui titik I .

Problem 5. It is known that there are n integers $a_1, a_2, \dots, a_n$ such that

$$a_1 + a_2 + \dots + a_n = 0 \quad \text{and} \quad a_1 \times a_2 \times \dots \times a_n = n.$$

Determine all possible values of n .

Diketahui bahawa wujud n integer $a_1, a_2, \dots, a_n$ sehinggakan

$$a_1 + a_2 + \dots + a_n = 0 \quad \text{dan} \quad a_1 \times a_2 \times \dots \times a_n = n.$$

Tentukan semua nilai yang mungkin bagi n .

Problem 6. Prove that there is a multiple of 2^{2022} that has 2022 digits, and can be written using digits 1 and 2 only.

Buktikan bahawa wujud suatu gandaan bagi 2^{2022} yang mempunyai 2022 digit, dan boleh ditulis dengan hanya menggunakan digit 1 dan 2 sahaja.

■ END OF PAPER ■