

9th World Mathematics Team Championship 2018

Advanced Level Individual Round 2

English Version

Instructions: This round has 8 questions (**40 minutes**).

Question numbers 1, 2, 3, 4, 5 and 6 are worth 4 points each.

Question numbers 7 and 8 are worth 8 points each.

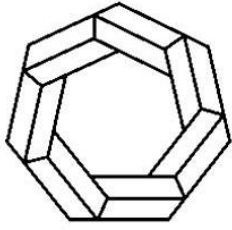
No point penalty for submitting wrong answers.

1. For a positive integer n denote by $d(n)$ the number of all positive divisors of n .
If $d(2n) = 28$ and $d(3n) = 30$ find $d(6n)$.

2. Solve the equation $\left(\frac{1}{3}\right)^{\log_{\frac{1}{2}}(x^2-2x+5)} = 9 - |x-1|$.

3. Point M is the midpoint of the side CD of a square $ABCD$. Point P on the diagonal AC is such that $\angle BPM = 90^\circ$. Find the ratio $\frac{PC}{PA}$.

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4. Compute $\sqrt{2 + \sqrt{2 + \sqrt{2 + \sqrt{2 + \dots}}}}$
5. The diagonals AC and BD of quadrilateral $ABCD$ are perpendicular. If $AB = 60$ cm, $BC = 52$ cm and $CD = 25$ cm, find AD .
6. Find the number of 5-digit positive integers with sum of their digits equals to 22 and without 0 in their decimal representation.
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7. To prepare for WMTC a student solved n problems during 31 day period. It is known that:
- From day 1 to day 14 inclusive he solved in average 5 problems per day
 - From day 6 to day 25 inclusive he solved in average 4 problems per day
 - From day 12 to day 31 inclusive he solved in average 3 problems per day
- Find the number of different values of n for which this is possible.
8. Find the number of ways 5 indistinguishable black balls and 5 indistinguishable white balls can be placed on a circle.
- If an arrangement is obtained from another one by rotation, the two arrangements are considered to be the same.