

9th World Mathematics Team Championship 2018

Advanced Level Individual Round 1

English Version

- Instruction:** This round has 15 questions (**20 minutes**).
Each question is worth 2 points.
No point penalty for submitting wrong answer.
Blank answer will be assigned 0.5 point.

1. Find the value of $\sqrt{9} + \sqrt{(3 - \sqrt{11})^2} + \sqrt[3]{(2 - \sqrt{11})^3}$.

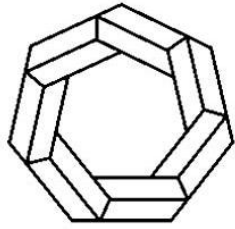
- A) $8 - 2\sqrt{11}$ B) 4 C) 2 D) $2\sqrt{11} - 2$ E) $2\sqrt{11}$

2. Find x if $2^{x-1} \times 5^{x-1} = 0.1 \times 10^{2x+5}$.

- A) -5 B) -4 C) -3 D) 3 E) 5

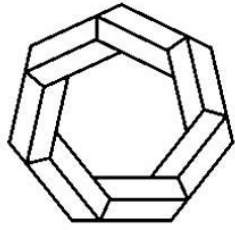
3. If $\cos \alpha = -\frac{1}{4}$ and $\pi \leq \alpha \leq \frac{3\pi}{2}$, find $\sin 2\alpha$.

- A) $\frac{\sqrt{15}}{4}$ B) $-\frac{\sqrt{15}}{4}$ C) $-\frac{\sqrt{15}}{8}$ D) $\frac{\sqrt{15}}{8}$ E) $\frac{\sqrt{15}}{16}$



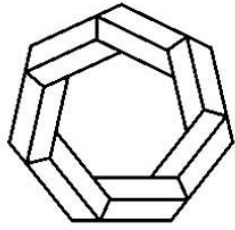
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4. In how many ways one can choose a group of leader, deputy leader and two members from a group of 10 persons?
- A) 2500 B) 2400 C) 5040 D) 2520 E) 210
5. One of the sides of a parallelogram equals 9 cm and the two altitudes are 6 cm and 10 cm. Find the length of the other side.
- A) 5.4 cm B) 13 cm C) 8 cm D) 7 cm E) 15cm
6. In how many ways 3 Bulgarian girls and 3 Chinese girls can sit in a bench such that the three Chinese girls are not sitting together next to each other.
- A) 144 B) 720 C) 576 D) 625 E) 216
7. Find $(3 + \sqrt{5})(\sqrt{10} - \sqrt{2})\sqrt{3 - \sqrt{5}}$.
- A) $\sqrt{3} - \sqrt{5}$ B) $3\sqrt{2}$ C) 5 D) 8 E) 10



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8. The number of solutions of $\begin{cases} x + xy + y = 7 \\ x^2y + xy^2 = 12 \end{cases}$ is:
- A) 1 B) 2 C) 4 D) 0 E) 3
9. The unit digit of the sum of all 3 digit numbers having only odd digits equals:
- A) 1 B) 2 C) 3 D) 4 E) 5
10. For what values of a and c the range of the function $y = ax^2 + c$ is the interval $\left[-\frac{1}{8}, \infty\right)$?
- A) $\begin{cases} a = -\frac{1}{8} \\ c > 0 \end{cases}$ B) $\begin{cases} a > 0 \\ c = -\frac{1}{8} \end{cases}$ C) $\begin{cases} a < 0 \\ c = -\frac{1}{8} \end{cases}$ D) $\begin{cases} a = -\frac{1}{8} \\ c = 0 \end{cases}$ E) $\begin{cases} a = 0 \\ c = -\frac{1}{8} \end{cases}$
11. A rectangle $ABCD$ and a point M are such that $MA = 2\sqrt{5}$, $MB = 2$ and $MC = 3$ find MD .
- A) $\sqrt{5}$ B) 5 C) $2\sqrt{5} + 1$ D) $2\sqrt{5} - 1$ E) $2\sqrt{6}$



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12. If $(1+i\sqrt{3})^{21} = a+bi$ for a and b real numbers find $\log_2 a^2$.

- A) 42 B) 21 C) 48 D) 63 E) -48

13. The solution of $(x^2 - 5x + 4)\sqrt{x-3} \leq 0$ is:

- A) [3,5] B) [3,4] C) [1,4] D) [3,∞) E) (3,4)

14. If $a = \log_{10} 25$ find $\log_2 \sqrt[3]{625}$.

- A) $\frac{4a}{3(2-a)}$ B) $\frac{4a}{3(a+2)}$ C) $\frac{3a}{2(3-2a)}$ D) $\frac{6a}{3a+4}$ E) $\frac{6a}{3a-4}$

15. Solve $\frac{x}{x^2+2} \sqrt{1+\frac{x^4+4}{4x^2}} = x+1$.

- A) $-\frac{1}{2}$ B) $\frac{3}{2}$ C) $\frac{1}{2}$ D) $-\frac{3}{2}$ E) -2