THAILAND INTERNATIONAL MATHEMATICAL OLYMPIAD FINAL ROUND 2020 – 2021

Primary 6

Time allowed: 120 minutes

Question Paper

Instructions to Contestants:

1. Each contestant should have ONE Question-Answer Book which CANNOT be taken away.
2. There are 5 exam areas and 6 questions in each exam area. There are a total of 30 questions in this Question-Answer Book. Each question carries 5 marks. Total score is 150 marks. No points are deducted for incorrect answers.
3. All answers should be written on ANSWER SHEET.
4. NO calculators can be used during the contest.
5. All figures in the paper are not necessarily drawn to scale.
6. Write down the answer in the simplest form. If the calculation result is a fraction, please write down the answer as a proper or mixed fraction, decimal figure is also accepted. Marks will NOT be given for incorrect unit.
7. This Question-Answer Book will be collected at the end of the contest.

DO NOT turn over this Question-Answer Book without approval of the examiner.

Otherwise, contestant may be DISQUALIFIED.

Open-Ended Questions (1^{st} ~30^{th}) (5 points for correct answer, no penalty point for wrong answer)

Logical Thinking

1. There are some chickens and rabbits in a cage. The number of chickens is five times as the number of rabbits. They have 266 legs in total. How many chicken(s) is / are there?

2. At a 30% discount, Alice bought a watch at $392. If the marked price is 60% higher than the recommended retail price, find the recommended retail price in dollars.

3. Find the average of the following sequence.
   37, 40, 43, 46, ... , 1501, 1504, 1507

4. Convert $0.28\dot{3}\dot{1}$ ($0.28313131\ldots$) into the simplest fraction.

5. At a dormitory, if we need to ensure there will be 6 people with the same date of birth in Year 2008, at least how many people are there at the dormitory?

6. There are 24 purple balls, 17 orange balls, 12 green balls and 26 white balls in a bag. At least how many balls should be picked up to ensure there are 9 purple balls, 3 green balls and 5 white balls?

Arithmetic

7. Find the value of $\frac{1}{17\times19}+\frac{1}{19\times21}+\frac{1}{21\times23}+\ldots+\frac{1}{49\times51}+\frac{1}{51\times53}$.

8. Find the value of $9+36+144+\ldots+9216+36864$.

9. Find the value of $2024\times1032-2021\times1022$.

10. Find the value of $\cfrac{1}{8-\cfrac{2}{6+\cfrac{3}{4-\cfrac{1}{5}}}}$.

11. Find the value of $31.7\times5360+3.17\times4900+0.317\times415000$.

12. Find the value of $\frac{938\times353+2814}{544\times89-712}$.

All answers should be written on the ANSWER SHEET.

Number Theory

13. How many simplified fraction(s) with denominator 2021 is / are there?

14. A 4-digit number has a remainder 5 when divided by 6, has a remainder 6 when divided by 7 and has a remainder 8 when divided by 9. What is such smallest 4-digit number?

15. What is the smallest 5-digit number (without repeated digits) that can be divisible by 15 and 27?

16. Find the unit digit of A if:
$$A=\underbrace{12\times12\times...\times12}_{2021's}\times\underbrace{534\times534\times...\times534}_{2022's}\times\underbrace{2398\times2398\times2398\times...\times2398}_{2023's}$$

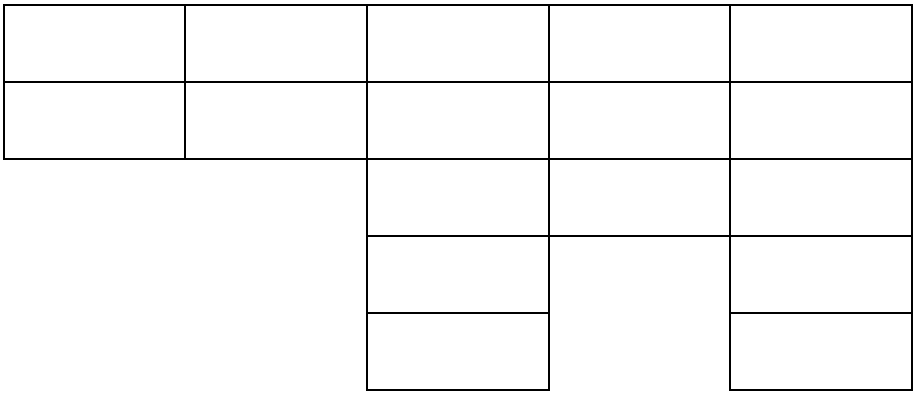
17. The sum of 13 consecutive odd numbers is 1183. What is the second largest number?

18. Define the operation symbol:
$$4\oplus2=\frac{4^2-2^2}{4-2}$$
$$5\oplus3=\frac{5^2-3^2}{5-3}$$
$$9\oplus6=\frac{9^2-6^2}{9-6}$$
Find the value of $(6\oplus3)\times(8\oplus5)$.

Geometry

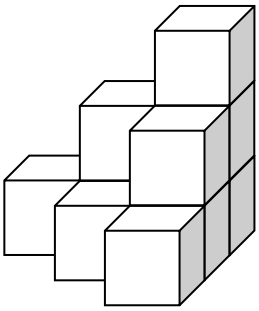
19. A cubic water tank with side length 25 cm has a water level of 9 cm. An iron cuboid with dimensions $5cm\times5cm\times33cm$ is inserted into the water tank vertically, what is the new water level? (in cm)

20. How many rectangle(s) is / are there in the figure below?

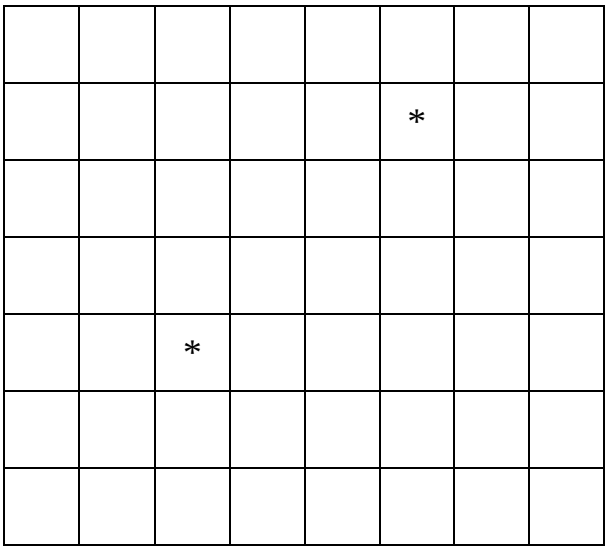


21. The area of a rectangle is 6063. If the sides of the rectangle are integers, how many different value(s) of perimeter of this rectangle is / are there?

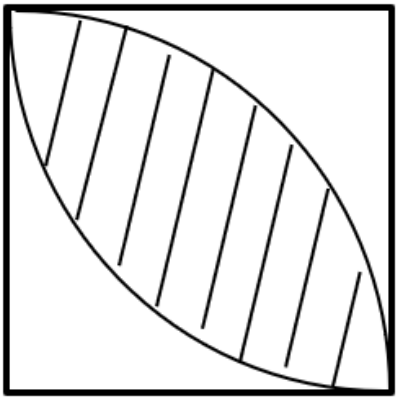
22. Small cubes with side length 1 are combined according to the pattern shown below. If there are 23 layers, find the surface area.



23. How many rectangle(s) with both 2 "*" is / are there in the figure below?



24. The figure below is a square overlapped by two quarter circles. If the area of the shaded region is 112, find the perimeter of the square. (Take $\pi = \frac{22}{7}$)



Combinatorics

25. A flight of stairs has 13 steps. Andy can go up for 1 step, 2 steps or 3 steps each time. The 8^{th} step cannot be stepped on as it is destroyed. How many way(s) is / are there for Andy to go up the stairs?

26. Numbers are drawn from 90 integers 38 to 127. At least how many number(s) is / are drawn randomly to ensure that there are two numbers whose sum is 149?

27. 7 identical brown vases, 2 identical white vases and 3 identical purple vases are put from left to right. How many different permutation(s) is / are there?

28. When do the hour hand and the minute hand overlap between 7 P.M and 8 P.M?

29. Now there are infinitely many rooms. If 7854 students are needed to separate into these rooms evenly, how many way(s) is / are there?

30. Choose 3 digits, without repetition, from 1, 2, 3, 4, 5, 6 to form 3-digit numbers. How many number(s) can be divisible by 18?

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