

# 亞洲國際數學奧林匹克聯合會

ASIA INTERNATIONAL MATHEMATICAL OLYMPIAD UNION



## 亞洲國際數學奧林匹克公開賽初賽

Asia International Mathematical Olympiad Open Trials

中一組 Grade 7

時限：70 分鐘

Time allowed: 70 minutes

試題

Question Paper

本試題不可取走。

THIS QUESTION PAPER CANNOT BE TAKEN AWAY.

未得監考官同意，切勿翻閱試題，否則參賽者將有可能被取消資格。

DO NOT turn over this Question Paper without approval of the examiner.

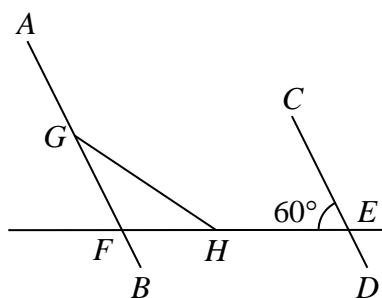
Otherwise, contestant may be DISQUALIFIED.

All answers should be written on the ANSWER SHEET.

Section A – each question carries 4 marks

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- 1) Alcohol solution A has a concentration of 3% and Alcohol solution B has a concentration of 4%. Solution A and solution B are mixed in ratio of mass of 5 :3. Find the concentration of the mixed solution.
- 2) There is a square and a rectangle. The area each of them is 100. Find the minimum possible difference between their perimeters.
- 3) A substance will double its volume every 10 minutes. When the 2016 Hong Kong & Macao Mathematical Olympiad Open Secondary 1 section starts a small amount of the substance is put in a container. The container is just fully occupied at the end of the competition. Given the internal volume of the container is  $1000\text{cm}^3$ , find the volume of the substance at the beginning of the competition. (Show your answer in decimals when necessary)
- 4) Find the value of  $3.\dot{1}\dot{3} + 2.\dot{0}\dot{1}\dot{6}$  and show your answer in recurring decimals.
- 5) In the figure below, if  $AB \parallel CD$ ,  $FG = FH$  and  $\angle AGH = x^\circ$ , find the value of  $x$ .



- 6) For an ordinary analog clock, at which interval (in minutes) the hour-hand and the minute-hand overlaps? (Show your answer in simplest fraction when necessary.)
- 7) 6 different three-digits numbers can be formed by using 3 distinct Arabic numerals (0-9). If the 6 integers formed this way has a sum of 4218, find the smallest possible 3-digit number formed by the three numerals.
- 8) Find the sum of all positive factors of 16313.

~ End of section A ~

請以最簡形式填寫答案。若計算結果是分數，請化至最簡，並確保為真分數或帶分數，或將計算結果寫成小數。

答案可以根式表示，唯該根式必須是最簡形式。除特別註明外，毋需填寫單位。錯誤單位將不給予任何分數。

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. You may use square root to represent the answer which is in the simplest form.

Unless otherwise stated, no need to write down any unit. Marks will NOT be given for incorrect unit.

All answers should be written on the ANSWER SHEET.

Section B – each question carries 5 marks

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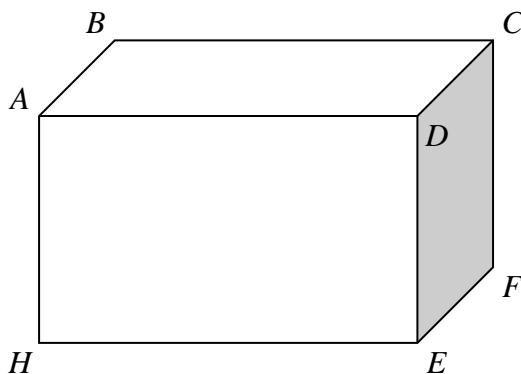
- 9) It is known that  $x$  is rational,  $x > 0$  and  $x = 3\sqrt{3\sqrt{3\sqrt{\dots}}}$ . Find the value of  $x$ .
- 10) If  $390625 = 5^8$ , find the value of  $1 + 5 + 25 + 125 + 625 + \dots + 390625$ .
- 11) In rectangular coordinate system. If  $M(x, y)$  is the mid-point of  $A(3, 13)$  and  $B(9, -3)$ . Find  $x + y$ .
- 12) It is known the two sides adjacent to the right angle of a right-angled triangle are in the ratio of  $1:3$ . If the length of the hypotenuse is 12, find the area of the triangle.
- 13) It is known that  $N^{13} = 302,875,106,592,253$ , find the value of  $N$ .
- 14) The competition time of 2016 Hong Kong & Macao Mathematical Olympiad Open Secondary 1 section is 16:00 – 17:10. During the competition, when does the minute-hand and the hour-hand overlap? (If necessary, show your answer in 24 hour system and simplest fraction)
- 15) It is known 13316 has 6 positive factors, find the sum of its prime factors.
- 16) There is a sequence. Its first term is 2016, its second term is 313. From the third term, each term is the average of the two preceding terms. Find the integral part of the 16<sup>th</sup> term.

~ End of section B ~

All answers should be written on the ANSWER SHEET.

Section C – each question carries 7 marks

- 17) In Cartesian coordinate system. It is known the coordinates of  $A$  and  $B$  are  $(-14, 6)$  and  $(7, -3)$  respectively.  $M$  is a point on  $AB$  such that  $AM : MB = 2 : 1$ . The line segment  $AB$  rotates about  $M$ , if the new position of  $B$  becomes  $(3, -7)$ , find the corresponding new coordinates of  $A$ .
- 18) Let  $a = 3.13 + 3.113 + 3.1113 + \dots + \underbrace{3.111\dots13}_{100 \text{ '1's}}$ , find the integral part of  $a$ .
- 19) In the figure, the length, width and height of the cuboid  $ABCDEFGH$  is 3, 5 and 13 respectively. Find the length of the diagonal  $AF$ .



- 20) There are 5 fair 6-sided dices, which the 6 faces of the dices show numbers from 1 to 6, are thrown. The outcomes are recorded in order (e.g. 11112 and 21111 are counted towards 2 different scenarios). Find the number of different scenarios which the sum of outcomes is 10.

~ End of Paper ~

請以最簡形式填寫答案。若計算結果是分數，請化至最簡，並確保為真分數或帶分數，或將計算結果寫成小數。答案可以根式表示，唯該根式必須是最簡形式。除特別註明外，毋需填寫單位。錯誤單位將不給予任何分數。

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. You may use square root to represent the answer which is in the simplest form.

Unless otherwise stated, no need to write down any unit. Marks will NOT be given for incorrect unit.