Annex 10

The Thirty-seventh Hong Kong Mathematics Olympiad (HKMO) (2019/20)

Aims / Objectives

This is to invite secondary schools to participate in the captioned competition.

Details

2. The Thirty-seventh Hong Kong Mathematics Olympiad (37th HKMO) is jointly organised by the Education Bureau and the Department of Mathematics and Information Technology of The Education University of Hong Kong. The aim of the competition is to develop students' mathematical abilities and foster their interest in mathematics.

3. The Heats will be held on 15 February 2020 (Saturday). The **50 teams** with the highest aggregate scores (sum of the scores in the **Individual Event** and **Group Event**) in the Heats will enter into the Finals which is scheduled for May 2020.

4. Starting from this cohort, the following changes will be adopted for the HKMO Heats:

(a) in order to enrich the Group Event, the Geometric Construction Event will be cancelled; and

(b) the Group Event will be extended from 20 minutes to 30 minutes. It will include 2 parts, part A consists of 5 questions with 2 marks each and part B consists of 5 questions with 4 marks each. The total score for the Group Event will be 30 marks.

The mode of Individual Event will remain unchanged. A sample paper for the group event is attached (Appendix 10c) for teacher's reference.

5. Schools interested in taking part in the 37th HKMO are requested to complete the attached Application Form (Appendix 10a) (or the e-form which is available on the website: https://www.edb.gov.hk/en/curriculum-development/kla/ma/res/sa/hkmo-index.html) and return it via **Fax** to the Mathematics Education Section, Curriculum Development Institute, Education Bureau (or email to robertcheng@edb.gov.hk) **on or before 17 January 2020 (Friday)**.

6. Regulations for the captioned competition are attached (Appendix 10b).

Contact Person

7. For enquiries, please contact Mr CHENG Sze-man of Mathematics Education Section, Curriculum Development Institute, Education Bureau on 2153 7436.

Appendix 10a

Application Form

Mathematics Education Section
Curriculum Development Institute
Education Bureau
4/F, Kowloon Government Offices
405 Nathan Road
Kowloon
Fax No.: 3426 9265 **Email: robertcheng@edb.gov.hk**
(Attn: Mr CHENG Sze-man)

The Thirty-seventh Hong Kong Mathematics Olympiad (2019/20)

My school would like to nominate the following students to take part in the captioned competition:

No.	Name of Student		Sex (M/F)	Class
	Name in English (**BLOCK LETTERS**)	Name in Chinese		
1				
2				
3				
4				
5				
6				

Dr / Mr /Mrs / Ms / Miss* _____ will be in charge of the school team.
** Delete whichever inapplicable.*

School Chop

Signature of Principal: _____

Name of Principal: _____

School: _____

Address: _____

_____

Tel. No.: _____ Fax No.: _____

Date: _____

Appendix 10b

The Thirty-seventh Hong Kong Mathematics Olympiad (2019/20)
Regulations (Heats)

1. The Heats consist of two parts: **60 minutes** for the individual event and **30 minutes** for the group event.

2. Each team should consist of 4 to 6 members who are students of **Secondary 5** level or below. Any 4 of them may take part in the individual event and any 4 of them may take part in the group event. Teams of less than 4 members will be disqualified.

3. Members of each team, **accompanied by the teacher-in-charge, should wear proper school uniform** and present **ID Card or student identification document** when registering at the venue reception not later than 9:00 a.m. Failing to do so, the team **will risk disqualification**.

4. Verbal instructions will be given in Cantonese. However, for competitors who do not understand Cantonese, written instructions in both Chinese and English will be provided. Question papers are printed in both Chinese and English.

5. Each member of a team has to solve 15 questions in the individual event (***10 questions in Part A*** and ***5 questions in Part B***), and each team has to solve 10 questions in the group event (***5 questions in Part A*** and ***5 questions in Part B***).

6. In the group event, discussions among participating team members are allowed provided that the voice level is kept to a minimum.

7. Please note that for the individual and group events, devices such as calculators, four-figure tables, protractors, compasses, set squares and rulers will **not** be allowed to use, otherwise the team will be disqualified or risk deduction of marks.

8. **All answers in the individual event and the group event should be numerical and reduced to the simplest form unless stated otherwise. No proof or demonstration of work is required.**

9. Participants having electronic communication devices (include tablets, mobile phones, multimedia players, electronic dictionaries, databank watches, smart watches or other wearable technologies with communication or data storage functions) or any alarm device(s), should turn them off and put them inside their bags or under their chairs. Failing to do so, the team **will risk disqualification**.

10. For the individual event, 1 mark and 2 marks will be given to each correct answer in Part A and Part B respectively. The maximum score for a team should be 80.

11. For the group event, 2 marks and 4 marks will be given to each correct answer in Part A and Part B respectively. The maximum score for a team should be 30.

12. No mark for speed will be awarded in the Heats.

13. Participants should bring along their own instruments, e.g. **ball pens** and **pencils**.

14. The 50 teams with the highest aggregate scores (sum of the scores in the individual event and the group event) will be qualified for the Finals.

15. Awards of the Heats:

    (a) For the individual event,

        (i) candidates obtaining full score will be awarded Best Performance and Score certificates ;

        (ii) apart from the best performer(s) in (i),

            (1) the first 2% of top scoring candidates will be awarded First-class honour certificates ;

            (2) the next 5% of top scoring candidates will be awarded Second-class honour certificates ; and

            (3) the next 10% of top scoring candidates will be awarded Third-class honour certificates ;

    (b) For the group event, teams obtaining full marks will be awarded Best Performance and Score certificates.

    (c) About 10% of participating schools with the highest aggregate scores (sum of the scores in the individual event and the group event) in each region will be awarded certificates of merit.

16. Should there be any queries, participants should reach the Centre Supervisor immediately after the competition. The decision of the Organising Committee on the queries is final.

Hong Kong Mathematics Olympiad (2019 / 2020)
Heats (Group Event) Sample Paper
香港數學競賽 (2019 / 2020)
初賽（團體項目）模擬試卷

Part A
甲部

1. 除非特別聲明，答案須用數字表達，並化至最簡。
   Unless otherwise stated, all answers should be expressed in numerals in their simplest form.
2. 本部各題佔分相等，每題 2 分。
   All questions in this section are of equal marks, each question carries 2 marks.

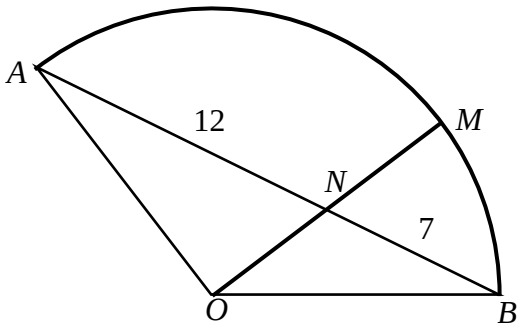
1. 設 $f(x)$ 為二次多項式，其中 $f(1)=\frac{1}{2}$，$f(2)=\frac{1}{6}$，$f(3)=\frac{1}{12}$。求 $f(6)$ 的值。

   Let $f(x)$ be a polynomial of degree 2, where $f(1)=\frac{1}{2}$, $f(2)=\frac{1}{6}$, $f(3)=\frac{1}{12}$. Find the value of $f(6)$. (2017/18 Group Event)

2. 已知 $f(x)-2f\left(\frac{1}{x}\right)=x$，其中 $x\neq 0$。設 y 為滿足方程 $f(x)=1$ 的 x 的最大值。求 y。

   Given that $f(x)-2f\left(\frac{1}{x}\right)=x$, where $x\neq 0$. Let y be the maximum value of x that satisfies the equation $f(x)=1$. Find y. (2018/19 Group Event)

3. 如圖一所示，OAB 是一個以 O 為圓心的圓的扇形。N 則為半徑 OM 與 AB 的交點。已知 $AN=12$，$BN=7$ 及 $3ON=2MN$。求 OM 的長。
   As shown in Figure 1, OAB is a sector of a circle with centre O. N is the intersecting point of the radii OM and AB. Given that $AN=12$, $BN=7$ and $3ON=2MN$. Find the length of OM.

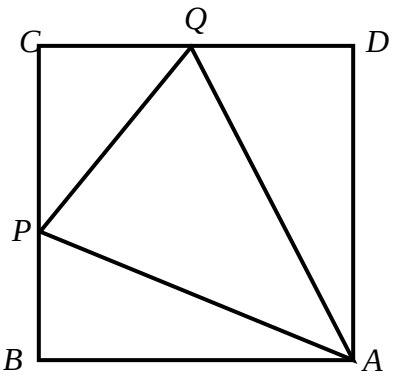


圖一
Figure 1

(2017/18 Group Event)

4. 如圖二所示，P、Q 分別是正方形 $ABCD$ 的邊 BC 及 CD 上的點。已知ΔPCQ 的周界的長等於正方形 $ABCD$ 的周界的長的 $\frac{1}{2}$，求 $\angle PAQ$。

As shown in Figure 2, P , Q are points on the sides BC and CD of a square $ABCD$. Given that the perimeter of ΔPCQ is $\frac{1}{2}$ of that of the square $ABCD$, find $\angle PAQ$.



圖二
Figure 2

(2016/17 Group Event)

5. 有多少對正整數 x、y 可滿足 $xy=6(x+y+\sqrt{x^2+y^2})$？〔答：12 〕

How many pairs of positive integers x, y are there satisfying $xy=6(x+y+\sqrt{x^2+y^2})$?

(2018/19 Group Event)

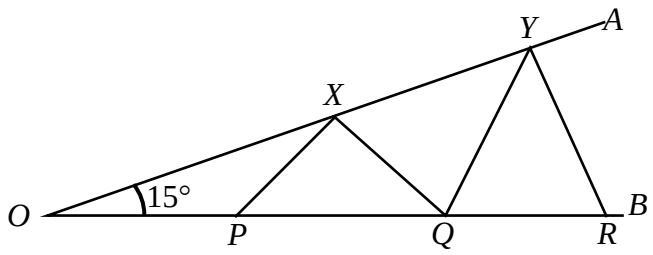
Part B
乙部

1. 除非特別聲明，答案須用數字表達，並化至最簡。
   Unless otherwise stated, all answers should be expressed in numerals in their simplest form.
2. 本部各題佔分相等，每題 4 分。
   All questions in this section are of equal marks, each question carries 4 marks.

6. 圖三中，$\angle AOB=15°$。X 、Y 是 OA 上的點，P 、Q 、R 是 OB 上的點使得 $OP=1$ 及 $OR=3$ 。若 $s=PX+XQ+QY+YR$，求 s 的最小值。

In Figure 3, $\angle AOB=15°$, X , Y are points on OA , P , Q , R are points on OB such that $OP=1$ and $OR=3$. If $s=PX+XQ+QY+YR$, find the least value of s .

(modified from 2015/16 Group Event)



圖三
Figure 3

7. 設三角形三條中線的長度為 9 、12 及 15。求該三角形的面積。
The lengths of the three medians of a triangle are 9, 12 and 15. Find the area of the triangle.

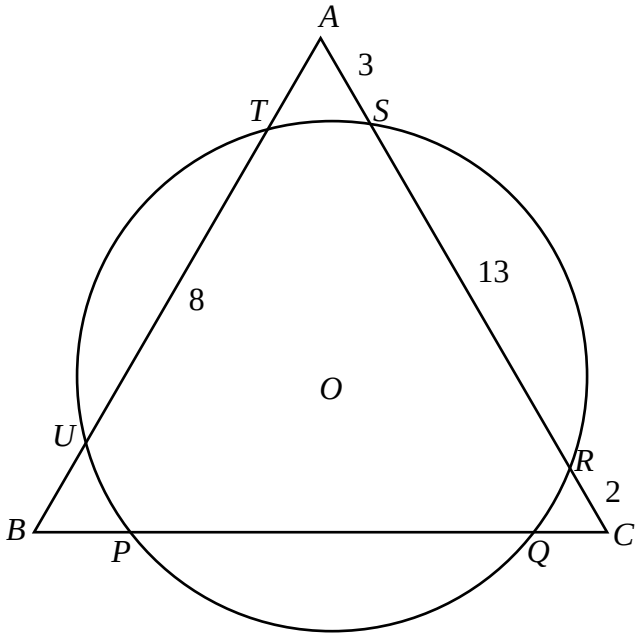
(2015/16 Group Event)

8. 求 $\dfrac{1^4+2015^4+2016^4}{1^2+2015^2+2016^2}$ 的值。
Find the value of $\dfrac{1^4+2015^4+2016^4}{1^2+2015^2+2016^2}$. (2015/16 Group Event)

9. 求 $\left(\frac{1}{2}+\frac{1}{3}+\cdots+\frac{1}{100}\right)+\left(\frac{2}{3}+\frac{2}{4}+\cdots+\frac{2}{100}\right)+\left(\frac{3}{4}+\frac{3}{5}+\cdots+\frac{3}{100}\right)+\cdots+\left(\frac{98}{99}+\frac{98}{100}\right)+\frac{99}{100}$ 的值。
Find the value of
$\left(\frac{1}{2}+\frac{1}{3}+\cdots+\frac{1}{100}\right)+\left(\frac{2}{3}+\frac{2}{4}+\cdots+\frac{2}{100}\right)+\left(\frac{3}{4}+\frac{3}{5}+\cdots+\frac{3}{100}\right)+\cdots+\left(\frac{98}{99}+\frac{98}{100}\right)+\frac{99}{100}$.

(2017/18 Group Event)

10. 在圖四中，*ABC* 是一個等邊三角形且與一圓相交於六點，*P*、*Q*、*R*、*S*、*T* 及 *U*。若 *AS* = 3，*SR* = 13，*RC* = 2 及 *UT* = 8，求 *BP* – *QC* 的值。
In Figure 4, *ABC* is an equilateral triangle intersecting the circle at six points *P*, *Q*, *R*, *S*, *T* and *U*. If *AS* = 3, *SR* = 13, *RC* = 2 and *UT* = 8, find the value of *BP* – *QC*.



圖四
Figure 4

(modified from 2016/17 Group Event)

END