



الجامعة الإسلامية العالمية ماليزيا  
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA  
يُونَيْتِيسِيْتِيْ اِسْلَامْ اِنْتَارَا بَحْسَا مَلَيْسِيَا

# IIUM Mathematics Competition (IMC 2016)

## FINAL

### SUBJECTIVE QUESTIONS

28<sup>th</sup> September 2016

3½ HOURS (9.45 am – 1.15 pm)

Name : \_\_\_\_\_

I/C No. : \_\_\_\_\_

#### INSTRUCTIONS TO STUDENTS:

1. This question paper consists of 6 printed pages with 5 questions.
2. Answer ALL questions in the spaces provided.
3. Students are allowed to use pencil, pen, eraser, and ruler ONLY.
4. Students are NOT allowed to bring a book, calculator, briefcase, hand phone, protractor, compass, etc.
5. Students are NOT allowed to discuss the questions during the examination.

Name: \_\_\_\_\_

School: \_\_\_\_\_

1. Twenty children stand in a circle (both boys and girls are present). For each boy, his clockwise neighbour is in a blue T-shirt, and for each girl, her counterclockwise neighbour is in a red T-shirt. Is it possible to determine the precise number of boys in the circle?

**(12 Marks)**

Dua puluh kanak-kanak lelaki dan perempuan berdiri dalam bulatan. Bagi setiap kanak-kanak lelaki, rakan yang berada pada pusingan arah jam memakai baju berwarna biru, dan bagi setiap kanak-kanak perempuan, rakan yang berada pada pusingan arah lawan jam memakai baju berwarna merah. Adakah kemungkinan untuk menentukan dengan tepat bilangan kanak-kanak lelaki dalam bulatan tersebut?

**(12 Markah)**

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2. Given an acute-angled triangle  $ABC$  with  $\angle C = 60^\circ$ . Let  $H$  be the point of intersection of its altitudes. The circle of radius  $HC$  centered at  $H$  meets the lines  $CA$  and  $CB$  for the second time at points  $M$  and  $N$  respectively. Prove that lines  $AN$  and  $BM$  are parallel or coincide.

**(12 Marks)**

Diberi segi tiga bersudut tirus  $ABC$  dengan  $\angle C = 60^\circ$ . Katakan  $H$  menjadi titik persilangan altitud itu. Bulatan berjejari  $HC$  berpusat di  $H$  melalui garis  $CA$  dan  $CB$  buat kali kedua, masing-masing pada titik  $M$  dan  $N$ . Buktikan sama ada garis  $AN$  dan  $BM$  adalah selari atau serentak.

**(12 Markah)**

Name: \_\_\_\_\_

School: \_\_\_\_\_

3. Is it possible that the sum and the product of 2016 integers are both equal to 2016?

**(12 Marks)**

Adakah kemungkinan untuk jumlah dan hasil darab 2016 integer kedua-duanya adalah sama dengan 2016?

**(12 Markah)**

Name: \_\_\_\_\_

School: \_\_\_\_\_

4. Find all pairs of integers  $(m, n)$  such that  $mn + n + 14 = (m-1)^2$ . **(12 Marks)**

Cari semua pasangan integer  $(m, n)$  yang memenuhi persamaan berikut  $mn + n + 14 = (m-1)^2$ .  
**(12 Markah)**

Name: \_\_\_\_\_

School: \_\_\_\_\_

5. The integers  $(-1, 2, -3, 4, -5, 6)$  are written on a blackboard. At each move, we erase two numbers  $a$  and  $b$ , and replace them by  $2a + b$  and  $a + 2b$  respectively. Then which of the following sextuples can be gotten?

$(0, 0, 0, 3, -9, 9); (0, 0, 0, 3, -6, 9); (0, 1, 1, -3, 6, -9); (0, 0, 2, 5, 5, 6).$

**(12 Marks)**

Enam integer  $(-1, 2, -3, 4, -5, 6)$  ditulis di papan hitam. Pada setiap langkah, dua nombor  $a$  dan  $b$ , digantikan dengan  $2a + b$  dan  $a + 2b$ . Yang manakah jawapan di bawah dapat diperolehi?

$(0, 0, 0, 3, -9, 9); (0, 0, 0, 3, -6, 9); (0, 1, 1, -3, 6, -9); (0, 0, 2, 5, 5, 6).$

**(12 Markah)**