Mathematics Exploration Problems

9th International Mathematics and Science Olympiad (IMSO) for Primary School 2012

Instructions:

* Write down your name and country on the answer sheet.

* Write your answer on the answer sheet.

* You have 120 minutes to work on this test.

* Use pen or pencil to write your answer.

"Smart, Skilled, and Creative In a Joyful Competition for Excellence"

City Montessori Inter College,

RDSO Campus, Manak Nagar, Lucknow, India

27 Oct. – 2 Nov 2012

EXPLORATION PROBLEMS

1. Fill in the positive integers 1 to 30 into the following boxes to form 15 fractions, with each number used exactly once, such that as many of these fractions as possible have integer values.

$$\frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square},\ \frac{\square}{\square}$$

2. A palindrome number is a positive integer that can be read the same way in either direction. For instance, 909, 3553 and 12421 are palindrome numbers. Find all 5-digit palindrome numbers divisible by 44.

3. The plane is divided into a number of non-overlapping polygons by *n* lines.
   What is the largest number of triangles among these polygons?
   (a) When *n*=5? (1 point)
   (b) When *n*=6? (2 point)
   (c) When *n*=7? (3 point)

4. Select as many of the integers from 1 to 21 as possible, so that no two disjoint pairs of them have the same difference. For example {1, 3, 5, 13} is such a collection; although $3-1=5-3$, the two pairs are not disjoint. On the other hand, {1, 2, 4, 7, 10} is not since $4-1=10-7$. What is the maximum number of integers that can be select?

5. Find a three-digit number such that the ratio of this three-digit number to the sum of its digit has the least value.

6. Place the numbers 1 to 42 in the squares of the 6 × 7 table so that any two consecutive numbers are in squares which share a common side. The numbers 11, 20 and 30 are already placed as shown in the diagram below.

	11	20				
	30					

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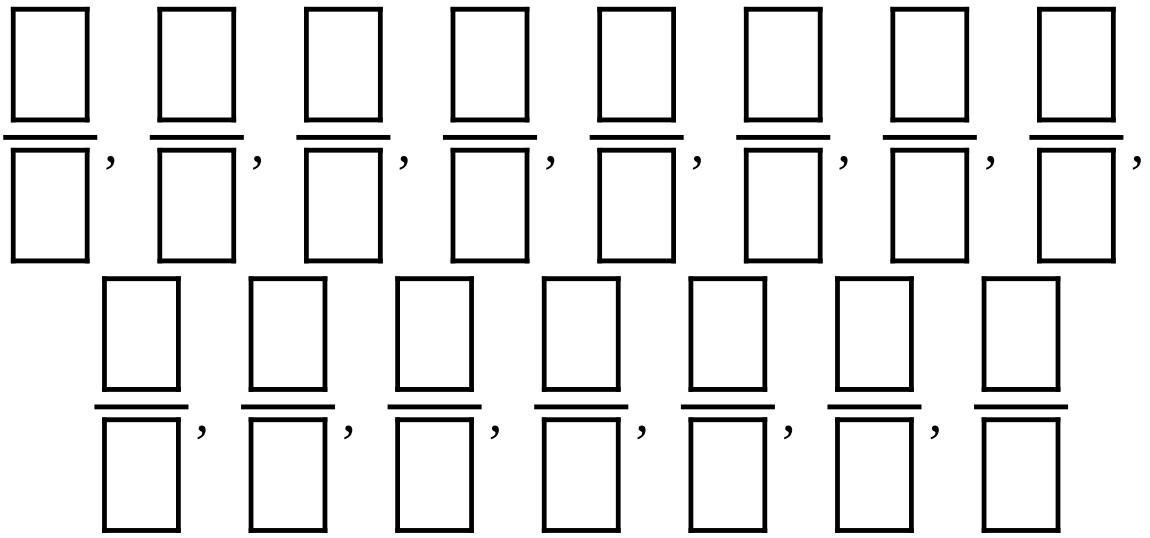
EXPLORATION PROBLEMS

NAME _____ *COUNTRY* _____

Answer Sheet

1.



2.

_____ , _____ , _____ , _____ ,
_____ , _____ , _____ , _____ ,
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_____ , _____ , _____ , _____ ,
_____ , _____ , _____ , _____ ,
_____ , _____ , _____ , _____ ,
_____ , _____ , _____ , _____ ,
_____ , _____ , _____ , _____ ,

3.

(a)	(b)	(c)

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EXPLORATION PROBLEMS

NAME _____ *COUNTRY* _____

Answer Sheet

4. The maximum number of integers that can be selected is _____.

5. The answer is _____.

6.

	11	20				
	30					