Mathematics Essay Problems

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10th International Mathematics and Science Olympiad (IMSO) for Primary School 2013

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Instructions:

* Write down your name and country on every page.

* You have 90 minutes to work on this test.

* Write down your detail solutions or working process in English in the space

 below the question.

* Use pen or pencil to write your answer.

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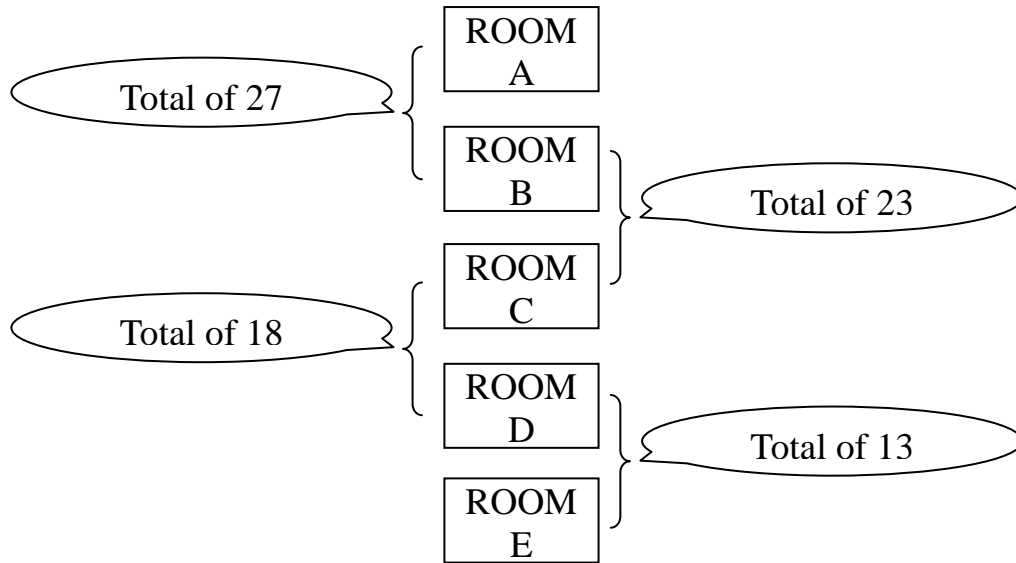
Alfonso, Cavite, Philippines

25 – 29 Nov 2013

Country**:**_____ Name**:** _____ No.**:**_____ Score: _____

NAME _____ *COUNTRY* _____

1. There were 50 students who attended a summer camp and they were assigned to five rooms. The details are indicated in the diagram below:

    How many students are there in each room?
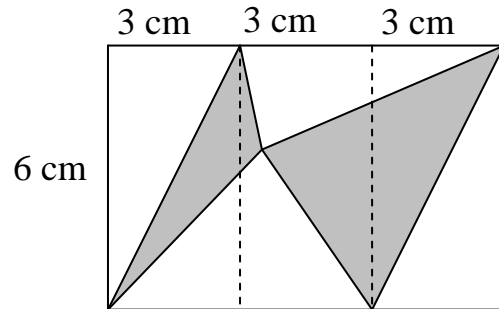
    Room A: _____ **students**   **Room B:** _____ **students**

    Room C: _____ **students**   **Room E:** _____ **students**

ANSWER: **Room E:** _____ **students**

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2. In the Figure below, three 6 cm $\times$ 3 cm rectangles are placed together in a row. Find the area of the shaded region.

3 cm   3 cm   3 cm

6 cm

ANSWER: _____ **cm^2**

3. The diagram below shows the multiplication of two three-digit numbers, yielding a six-digit product. Some of the digits are replaced by boxes. What is the value of this six-digit product?

```
            ☐  1  ☐
      ×     3  ☐  2
      _____
            ☐  3  ☐
         3  ☐  ☐  ☐
      ☐  ☐  ☐  5
      _____
   ☐  ☐  ☐  ☐  3  ☐
```

ANSWER: _____
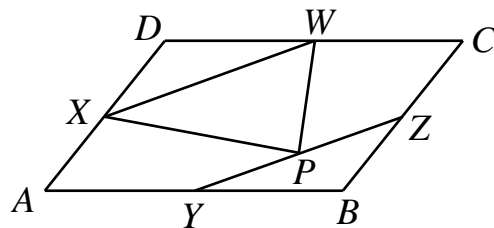
ESSAY PROBLEMS

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4. Twenty-seven digits arranged in a row of boxes must consist each of 1, 2, 3, 4, 5, 6, 7, 8 and 9 such that each digit is repeated three times. There is another digit between the first 1 and the second 1, and another digit between the second 1 and the third 1. There are two other digits between the first 2 and the second 2, and two other digits between the second 2 and the third 2. The same applies to the other digits, so that there are nine other digits between the first 9 and the second 9, and nine other digits between the second 9 and the third 9. The middle seven digits are 7469258. Complete the boxes below.

ANSWER:

							7	4	6	9	2	5	8								

5. *W*, *X*, *Y* and *Z* are the midpoints of the four sides of parallelogram *ABCD*. *P* is a point on the line segment *YZ*. What percent of the area of parallelogram *ABCD* is the area of triangle *PXW*?
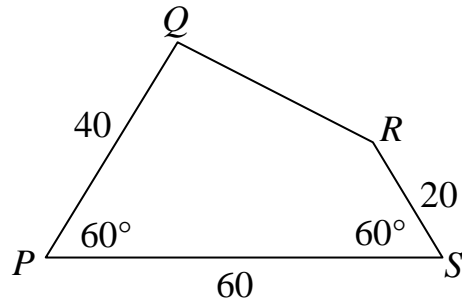

ANSWER: _____ %

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6. Four rods are connected together with flexible joints at their ends to make a quadrilateral as shown. If *PQ*=40 cm, *RS*=20 cm, *PS*=60 cm   and $\angle QPS = \angle RSP = 60°$. Find $\angle QRS$.

ANSWER: _____ °

7. What is the units digit for the following sum: $3^{2011} + 4^{2012} + 7^{2013}$?

ANSWER: _____

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8. In a multi-digit positive integer multiple of 7, every digit except the units digit is 6. What are the possible values of units digits?

   ANSWER: _____

9. The '4' button on my calculator is defective, so I cannot enter numbers which contain the digit 4. Moreover, my calculator does not display the digit 4 if 4 is part of an answer. Thus I cannot enter the calculation 2×14 and do not attempt to do so. Also, the result of multiplying 3 by 18 is displayed as 5 instead of 54 and the result of multiplying 2 by 71 is displayed as 12 instead of 142. If I multiply a positive one-digit number by a positive two-digit number on my calculator and it displays 26, list all possibilities which I could have multiplied?

   ANSWER: _____

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10. My twelve-hour clock has four digits, two for the hours and two for the minutes. The minutes are shown with leading 0s, but the hours are not. Upside down, the digits 0, 1, 2, 5, 6, 8 and 9 read 0, 1, 2, 5, 9, 8 and 6 respectively. One day, I made a phone call on the appointed time, and learned that it was too early. Then I realized that I had read the clock upside down. If you know by how much I was early, you will know what time I made the call. What time should I have made the call?

*ANSWER:*_____ : _____

11. There are 15 real coins all of the same weight, and one fake coin which is either heavier or lighter. At least how many times should we weigh so that we can determine whether the fake coin is heavier or lighter?
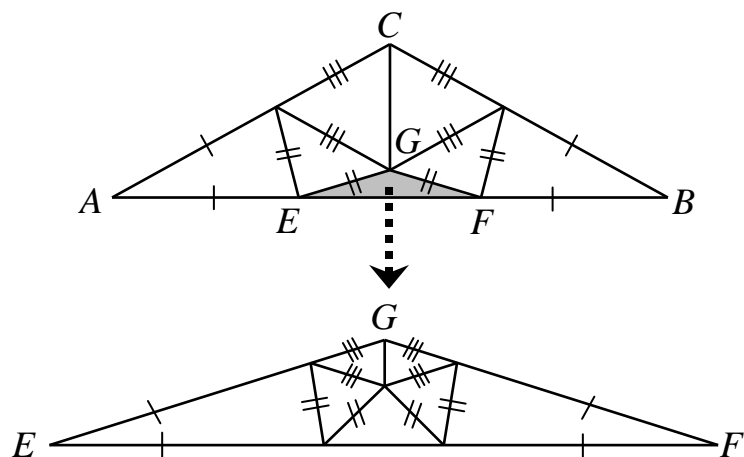
*ANSWER:*_____

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12. In a chess tournament with 15 players, every two play a game against each other once. A win is worth 2 points, a draw 1 point and a loss 0 points. A prize is given to any player with a total score of at least 20 points. What is the maximum number of prize winners?

ANSWER: _____

13. Isosceles triangle *ABC* has been dissected into thirteen isosceles acute triangles, as shown in the two following figures, where all segments of the same length are marked the same way, and the second figure shows the details of the dissection of △*EFG*. Given that ∠*CAB* is an integral number of degrees, what is the size of ∠*CAB* ?

○

ANSWER: _____