Malpi International School
Panauti, Kavre, Nepal.

NEPAL TOURISM YEAR 2011
NATURALLY NEPAL
ONCE IS NOT ENOUGH

Asia Inter-Cities Teenager's Mathematics Olympiad
NEPAL - 2011

AITMO NEPAL 2011
Asia Inter-Cities Teenagers Mathematics Olympiad
Nepal Tourism Year 2011

Individual Contest

Time limit: 120 minutes 2011/11/15

Instructions:

- Do not turn to the first page until you are told to do so.
- Remember to write down your team name, your name and Contestant number in the spaces indicated on the first page.
- The Individual Contest is composed of two sections with a total of 120 points.
- Section A consists of 12 questions in which blanks are to be filled in and only **ARABIC NUMERAL** answers are required. For problems involving more than one answer, points are given only when **ALL** answers are correct. Each question is worth 5 points. There is no penalty for a wrong answer.
- Section B consists of 3 problems of a computational nature, and the solutions should include detailed explanations. Each problem is worth 20 points, and partial credit may be awarded.
- Diagrams are **NOT** drawn to scale. They are intended only as aids.
- You have a total of 120 minutes to complete the competition.
- No calculator, calculating device, watches or electronic devices are allowed.
- Answer the problems with pencil, blue or black ball pen.
- All papers shall be collected at the end of this test.

*Name:*________________ *No.*________ *Team:*__________

<table>
<tr><td colspan="12">Section A</td><td rowspan="2">Total Score</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr>
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<tr><td colspan="12">Section B</td></tr>
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Individual Contest

Time limit: 120 minutes **2011/11/15**

Section A.

In this section, there are 12 questions. Fill in the correct answer on the space provided at the end of each question. Each correct answer is worth 5 points.

1. Let $6! = a!\times b!$ where $a>1$ and $b>1$. What is the value of $a\times b$?

Answer : ______________

2. If $3^{2011}+3^{2011}+3^{2011}+3^{2011}+3^{2011}+3^{2011}+3^{2011}+3^{2011}+3^{2011}=3x$, then what is the value(s) of x?

Answer : ______________

3. The perimeter of a square lawn consists of four straight paths. Anuma and Gopal started at the same corner at the same time, running clockwise at constant speeds of 12 and 10 kilometres per hour respectively. Anuma finished one lap around the lawn in 60 seconds. For how many seconds were Anuma and Gopal together on the same path in one lap?

Answer : ______________ seconds

4. If $a_1=12\times 8$, $a_2=102\times 98$, $a_3=1002\times 998$, $a_4=10002\times 9998$, $\cdots$ and $S=a_1+a_2+a_3+a_4+\cdots+a_{20}$, then what is the sum of all the digits of S?

Answer : ______________

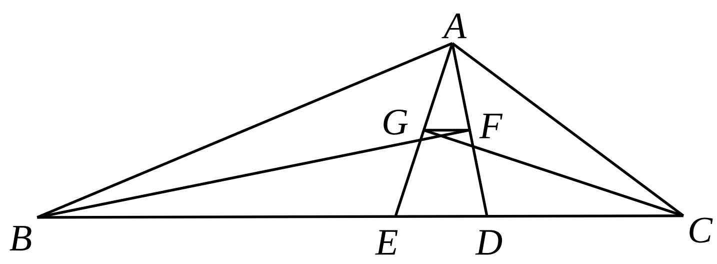
5. How many different bags, each containing 10 marbles of four different colours, can be bought if each bag must contain at least one marble of each colour?

Answer : ______________ bags

6. Find the value of n, if the sum of even positive integers between n^2-n+1 and n^2+n+1 is a number between 2500 and 3000.

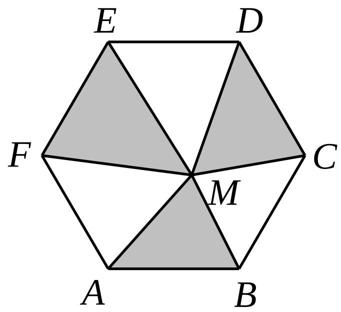
Answer : ______________

7. In triangle ABC, $BC = 56$, $CA = 25$ and $AB = 39$. D and E are points on BC such that $BD = BA$ and $CE = CA$. The bisector of $\angle B$ meets AD at F, and the bisector of $\angle C$ meets AE at G. Determine the length of FG.



Answer : ______________

8. The length of each side of a regular hexagon is 10. M is a point in it and $BM = 8$. What is the sum of the areas of triangles ABM, CDM and EFM?



Answer **:** ______________________

9. Find the product xyz where x, y and z are positive integers and $2^x + 7^y = z^4$.

Answer **:** ______________________

10. To determine the source of news in the employees of a company, N people have been interviewed and the following results have been obtained :
    A) 50 people use TV as well as other sources
    B) 61 people do not use radio
    C) 13 people do not use newspaper
    D) 74 people use at least two sources

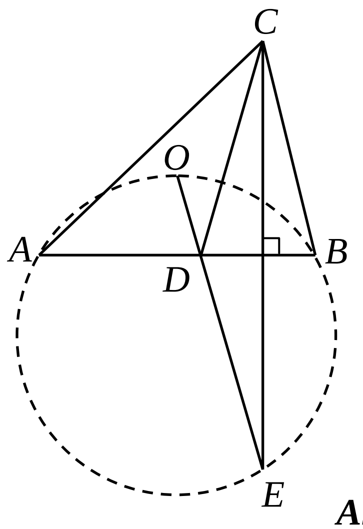
    If the sources contain only newspaper, TV and radio, what is the least value of N?

Answer **:** ______________________

11. Each of 2011 numbers is 1, 0 or -1. Determine the minimum value of the sum of all products of these numbers, taken two at a time.

Answer **:** ______________________

12. In acute triangle ABC, CD is bisector of $\angle C$, O is the circumcenter. The perpendicular from C to AB meets line OD in a point lying on the circumcircle of AOB. Find $\angle C$, in degree.



Answer **:** ______________________ °

Section B.

Answer the following 3 questions. Show your detailed solution on the space provided after each question. Each question is worth 20 points.

1. Let n be a positive integer such that $n! = 1 \times 2 \times 3 \times \cdots \times n$. What is the result of $\dfrac{3}{1!+2!+3!}+\dfrac{4}{2!+3!+4!}+\dfrac{5}{3!+4!+5!}+\dfrac{6}{4!+5!+6!}+\dfrac{7}{5!+6!+7!}+\dfrac{8}{6!+7!+8!}$?

Answer **:** ____________________

2. There is an integral number in each cell of an $n \times n$ table. In each move, we may change the signs of all the numbers in any row or column. Prove that after a finite number of such moves, it is possible to have the sum of the numbers in each row and column to be non-negative.

3. In an acute triangle *ABC*, the longest altitude *AH* has the same length as the median *BM*. Prove that $\angle ABC \le 60°$.