International Young Mathematicians' Convention (IYMC)
2012 Team Contest –Senior level

Time：60 minutes

Instructions:

- Do not turn to the first page until you are told to do so.
- Remember to write down your team name in the space indicated on every page.
- There are 6 problems in the Team Contest, arranged in increasing order of difficulty. Each question is printed on a separate sheet of paper. Each problem is worth 40 points and complete solutions of all problems are required for full credits. Partial credits may be awarded. In case the spaces provided in each problem are not enough, you may continue your work at the back page of the paper.
- The three team members are allowed 10 minutes to discuss and distribute the problems among themselves. Each student must attempt at least one problem. Each will then have 50 minutes to write the solutions of their allotted problem independently with no further discussion or exchange of problems.
- No calculator or calculating device or electronic devices are allowed.
- Answer must be in pencil or in blue or black ball point pen.

Team Code ____________________

For Juries Use Only

No.	1	2	3	4	5	6	Total
Score							
Sign by Jury							
Score							
Sign by Jury							

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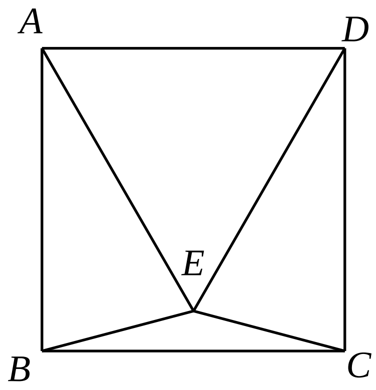
Team Name ______________________________ *Score* __________

1. In the figure, E is a point inside the square $ABCD$ such that $BE=CE$ and $\angle BEC = 150°$. Prove that $\triangle ADE$ is an equilateral triangle.



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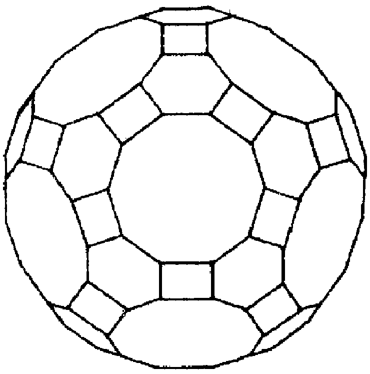
2. The figure shows a polyhedron in which each vertex lies on one regular decagon, one regular hexagon and one square. If this polyhedron have *V* vertices, *E* edges, *F* faces, find the value of *V*+*E*+*F*.



ANSWER: ____________________

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3. Five boxes contain 120 coins in all. Some are golden coins, some are silver coins and the rest are copper coins. Any two boxes contain less than 30 golden coins. Any three boxes contain less than 20 silver coins. Prove that some four boxes contain at least 15 copper coins.

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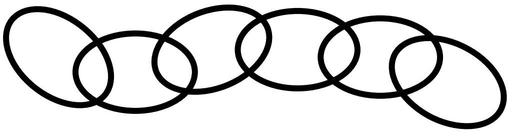
4. A man uses a gold chain consisted of 159 links to repay a debt. By agreement, he must hand in one link per week. He may hand in more links if he can get exact change. The debt is paid when all 159 links have been handed in. What is the minimum number of links that must be broken?



ANSWER: ____________________________

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5. The sequence { $f(1), f(2), f(3), ...$ } of increasing positive integers satisfies $f(f(n)) = 3n$. Find the value of $f(2012)$.

ANSWER: ______________________

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6. In the figure, P and Q are two distinct points inside the acute triangle ABC .
   If $\angle APB = \angle BPC = \angle CPA = 120°$. Prove that $PA+PB+PC<QA+QB+QC$.