2^{nd} International Mathematics Assessments for Schools (2012-2013)

Junior Division Round 2

Time: 120 minutes

Printed Name: ____________________ *Code*: ______________ *Score*: ____________

Instructions:

- Do not open the contest booklet until you are told to do so.
- Be sure that your name and code are written on the space provided above.
- Round 2 of IMAS is composed of three parts, total score is 100 marks.
- Questions 1 to 5 are given in multiple-choice test. Each question has five possible options marked as A, B, C, D and E. Only one of these options is correct. After making your choice, fill in the appropriate letter on the space provided. Each correct answer is worth 5 marks. There is no penalty for an incorrect answer.
- Questions 6 to 13 are short answer test. Only Arabic numerals are accepted; using other written text will not be honored or credited. Some questions have more than one answer, as such all answers are required to be written down on the space provided to obtain full marks. Each correct answer is worth 5 marks. There is no penalty for incorrect answer.
- Questions 14 and 15 require detailed solution or process in which 20 marks are to be awarded to completely written solution. Partial marks may be given to incomplete presentation. There is no penalty for an incorrect answer.
- Using of electronic computing devices is not allowed.
- Only pencil, blue or black ball-pens may be used to write your solution or answer.
- Diagrams are not drawn to scale. They are intended as aids only.
- After the contest the invigilator will collect the contest paper.

The following area is to be filled up by the judges;
the contestants are not supposed to mark anything here.

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total Score	Signature
Score																	
Score																	

Junior Division Round 2

Questions 1 to 5, 4 marks each

1. In a promotional sale, anyone who buys a cup of juice at the regular price of 7 dollars can get a second cup of juice by paying 1 more dollar. What is the minimum number of dollars a party of 9 people must pay if each of them wants a cup of juice?

（A）32　　（B）36　　（C）39　　（D）40　　（E）63

Answer：________________

2. Into the expression $y=\frac{x^2}{1+x^2}$, we substitute for x the numbers $\frac{1}{2012}$, $\frac{1}{2008}$, $\frac{1}{2004}$, …, $\frac{1}{4}$, 4, 8, 12, …, 2012. What is the sum of all the y values?

（A）1　　（B）16　　（C）251.5　　（D）503　　（E）2012

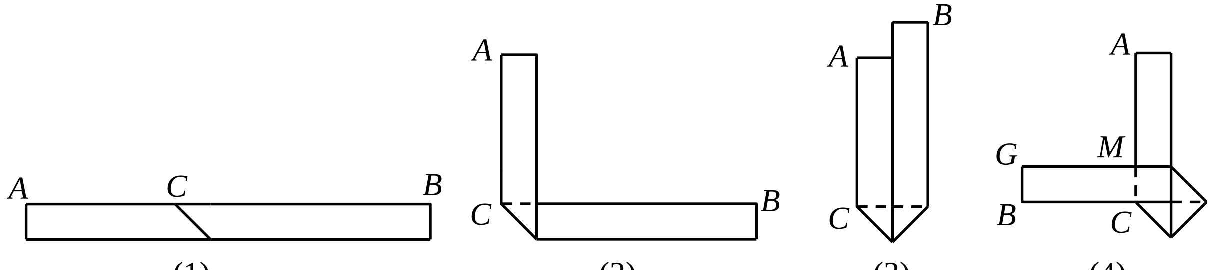
Answer：________________

3. In a flower shop, each Carnation sells for \$3 and each Rose sells for \$4. A bouquet is a combination of these two kinds of flowers. How many different bouquets selling for \$60 are there?

（A）4　　（B）5　　（C）6　　（D）7　　（E）8

Answer：________________

4. A rectangular strip, 30 cm in length and 3 cm wide, is folded in a pattern shown in diagram (2), producing a right angle $\angle ACB$. After the strip is completely folded as shown in diagrams (3) and (4), the lengths of AM and GM are equal. What is the length of AC in diagram (1)?



(1)　　(2)　　(3)　　(4)

（A）7.5　　（B）10.5　　（C）13.5　　（D）14.5　　（E）16.5

Answer：________________

5. Let a, b, c be rational numbers such that $c=-\frac{ab}{a+b}$. Which of the following expressions is correct?

（A） $a+b+c=a^3+b^3+c^3$ （B） $(a+b+c)^2=a^2+b^2+c^2$
（C） $(a+b+2c)^2=a^2+b^2-4c^2$ （D） $(a+b+c)^3=a^3+b^3+c^3$
（E） $(a+b+c)(a^2+b^2+c^2)=a^3+b^3+c^3+abc$

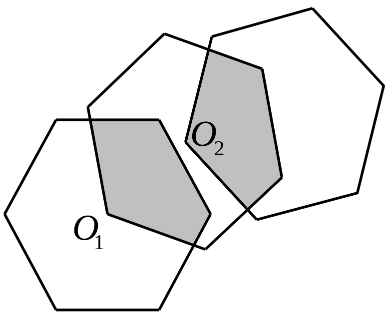
Answer： ______________

Questions 6 to 13, 5 marks each

6. In an isosceles triangle *ABC*, *AB* = *AC*. Point *D* lies on side *AC*, so that *AD* = *DB* = *BC*. What is the measure of $\angle BAC$？

Answer： ________ degrees

7. The diagram below shows three overlapping regular hexagons, each with side length 12 cm^2. One of the vertices of the middle hexagon coincides with the center O_1 of the hexagon on the left, while one of the vertices of the hexagon on the right coincides with the center O_2 of the middle hexagon. What is the total area of the two shaded parts?

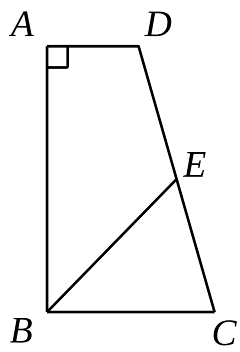


Answer： ________ cm^2

8. Let a and b be real numbers such that $3^a=2013$ and $671^b=2013$. What is the value of $\frac{1}{a}+\frac{1}{b}$?

Answer： ______________

9. In the diagram below, $ABCD$ is a right-angled trapezoid such that AD // BC and E is the midpoint of CD. If BE = 20 cm and $AB = AD + BC$, determine the area of trapezoid $ABCD$, in cm^2?



Answer： ________ cm^2

10. If a 7-digit number $\overline{20ab13c}$ is divisible by 792, what is the value of $c(a+b)$?

Answer： ________

11. In a party each of the participant handshakes with four women and six men. Given that the known number of handshakes between opposite-sex participants is seven times less than the number of handshakes between same-sex participants, how many men are there in the party?

Answer： ________

12. We put 130 identical balls into several identical boxes, such that the number of balls in each box is at least 10 but at most 20. The numbers of balls in the boxes are all different. How many distinct ways of putting these balls in the boxes are there?

Answer： ________ ways

13. Let a and b be non-negative integers less than 100. If $a-2b$ is a positive prime number and $2ab$ is a perfect square number, what is maximum value of $a+b$?

Answer： ________

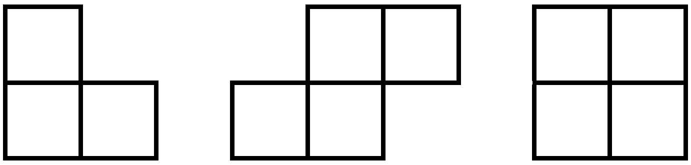
Questions 14 to 15, 20 marks each

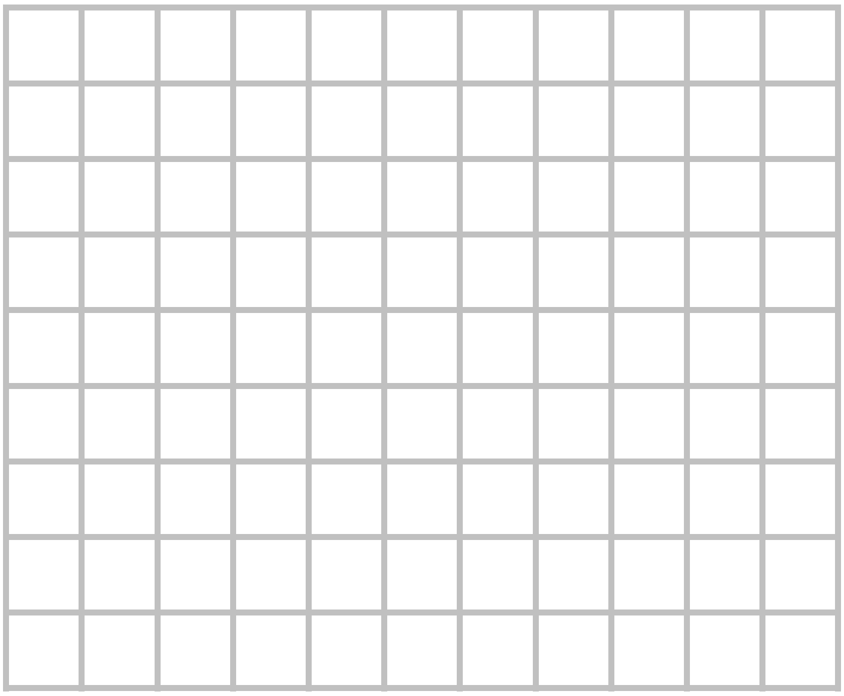
Detailed solutions are needed for these two problems

14. Let k be a real number. The product of all the real roots of the equation $x^4+2x^3+(3+k)x^2+(2+k)x+2k=0$ is -2012. Find the sum of the squares of the real roots.

Answer：

15. A 9 × 11 chessboard may be covered without overlap with a combination of the following three shapes. What is the minimum number of copies of the piece consisting of three squares must be used?





Answer：________________