International Mathematics Assessments for Schools

2011 JUNIOR DIVISION SECOND ROUND PAPER

Time allowed：120 minutes

Name: ____________________ Contestant number: __________ Score: ______________

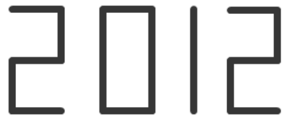
INSTRUCTION AND INFORMATION

- Do not open the booklet until told to do so by your teacher.
- Remember to write down your name and contestant number in the spaces indicated on this page.
- The second round paper is composed of three sections with a total of 100 points.
- Question 1~5 in which blanks are to be filled in and only **ENGLISH LETTER** are required. Only one answer in each question. Each question is worth 4 points. There is no penalty for a wrong answer.
- Question 6~13 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.
- Complete solutions of question 14 and 15 are required for full credits. Partial credits may be awarded. Each problem is worth 20 points.
- No calculator or calculating device or electronic devices are allowed.
- Answer must be in pencil or in blue or black ball point pen.
- All papers shall be collected at the end of this test.

2011 JUNIOR DIVISION SECOND ROUND PAPER

Questions 1-5, 4 marks each

1. The diagram shows a neon-light sign by the river representing the number “2012” for the New Year Party of a certain city celebrating the arrival of 2012. Looking at the reflection off the water from the opposite shore, how does the sign look?



（A）2102　（B）5015　（C）5105　（D）5012　（E）2015

ANSWER：________

2. In the centenary celebration of IMAS International School, a basketball tournament was organized. After each team had played exactly three games, six teams were eliminated. The surviving teams then played one another exactly once. In all, 33 games were played. How many teams participated in this tournament?

（A）16　（B）23　（C）24　（D）12　（E）26

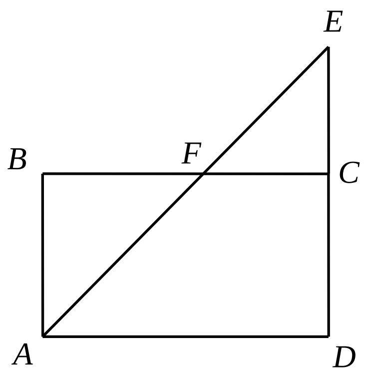
ANSWER：________

3. There are four kids. If we compute the total ages of three of them at a time, the sums are 22, 20, 17 and 25 respectively. What is the difference in age between the oldest and the youngest among these four kids?

（A）4　（B）5　（C）6　（D）7　（E）8

ANSWER：________

4. The diagram shows a point E on the extension of the side DC of a rectangle $ABCD$. The segment AE intersects the side BC at F. Three ants, X, Y and Z, all start from A. X crawls along the path A-B-F-C, Y along A-F-E-C-D and Z along A-F-C-D. All three crawl at the same constant speed. What is their order of finish to their respective destinations? List them from the one which finishes soonest to the one which finishes latest.



（A）XYZ　（B）XZY　（C）YXZ
（D）YZX　（E）ZXY

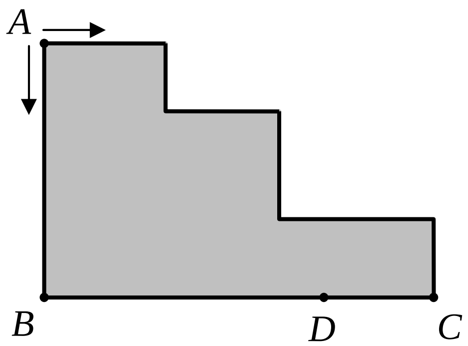
ANSWER：________

5. The currency of a certain country consists of bills of denominations \$1, \$5, \$10, \$20, \$50 and \$100. One day, two customers came to John's confectionery shop. Each bought a box of chocolate which cost \$15. The first customer had two \$10 bills and the second one a \$20 bill and a \$5 bill. Having no money in the tilt, John was unable to give change when the customer paid separately. However, the first customer could pay the second customer with his two \$10 bills and receive the \$5 bill as change, and then the second customer could pay John the \$20 bill and one \$10 bill for both boxes. On another day, two customers came, and each bought a box of caramel. Once again, the tilt was empty, and the correct change could only be made if the two customers paid together. Among the following prices, which could have been that of a box of caramel?
（A） \$2　　（B） \$5　　（C） \$6　　（D） \$7　　（E） \$8

ANSWER：__________

Questions 6-13, 5 marks each

6. The diagram shows a city block (shaded). Peter starts from *A* and moves to the east while Toney starts from *A* and moves to the south. They both follow the perimeter of the city block, and eventually meet at the point *D* on the side *BC*, 2 km from *C*. If the constant speed of the Toney is $\frac{3}{4}$ of the constant speed of the Peter, what is the length of the zig-zag line from *A* to *C*?



ANSWER：__________ km

7. A Youth Hostel has twenty-one rooms numbered from 1 to 21. To conceal their identifies from outsiders but not from the staff, the keys are assigned two-digit codes. The first digit is the remainder when the room number is divided by 3, and the second digit is the remainder when the room number is divided by 7. For instance, the key to room 8 has the code 21. Which room has the key with the code 12?

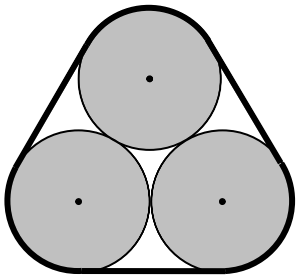
ANSWER：__________

8. The diagram shows a 3×3 table in which three squares have been filled with numbers. The remaining squares are also to be filled with numbers so that the sum of each row, each column and each of the two diagonals are the same. What number goes into the square marked A?

A		7
	10	3

ANSWER：

9. The diagram shows a rubber band tightly wrapped around three identical solid cylinders (shaded). The base radius of each cylinder is 10 cm. What is the total area, in cm^2, of the unshaded regions within the rubber band? Give the answer in terms of π.

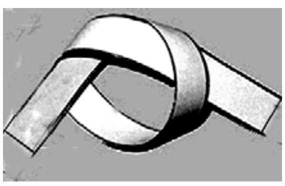


ANSWER： cm^2

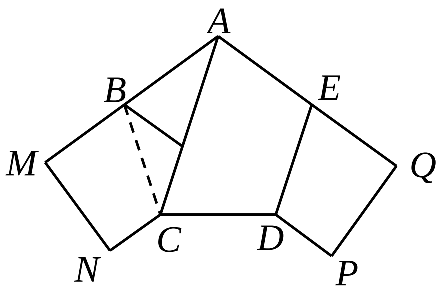
10. A magic number is a positive integer with distinct digits such that the difference between the number obtained by writing its digits in descending order and the number obtained by writing its digits in ascending order is equal to the positive integer itself. For example, 495 is a magic number since $954-459=495$. Find all four-digit magic numbers.

ANSWER：

11. The diagram shows how a regular pentagon *ABCDE* may be constructed by tying a knot in a rectangular piece of paper. If the dimensions of the original rectangle is 17.2 cm by 2.5 cm, and *CN*+*DP*=*CD*, what is the area, in cm^2, of the quadrilateral *ACDE*?



Figure（1）



Figure（2）

ANSWER： cm^2

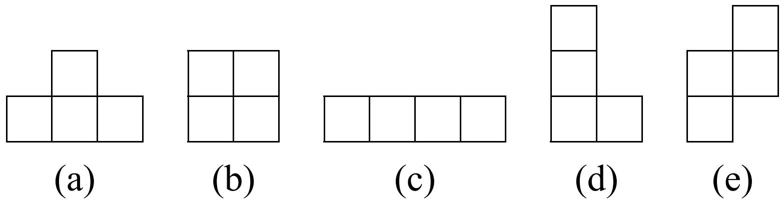
12. The integers a_1, a_2, b_1, b_2, c_1, c_2 and M satisfy

$$(a_1x+b_1y+c_1)(a_2x+b_2y+c_2)=2x^2+10xy+My^2+7x+18y+6$$

for any numbers x and y. What is the value of M ?

ANSWER：

13. As shown in the diagram, there are five pieces used in the video game Tetris. We have four identical copies of each piece. From the twenty copies, we choose four and try to use them to form a 4×4 square. The copies may be turned or flipped. How many different choices are there?



ANSWER：

Questions 14 and 15, complete solutions are required for full credits, 20 marks each

14. Given an arbitrary rectangle $ABCD$, find a point E on the side BC such that the total length of the segments AE and DE is as large as possible. Justify your answer.

ANSWER：

15. As shown in the diagram, Leon has a 5×5 sheet of stamps. He cuts out the 5 stamps marked X. In doing so, he satisfies the following three conditions.

（1）No stamps on the edge or at a corner can be cut.

（2）If two stamps share a common edge, they cannot both be cut.

（3）After cutting, the remaining part of the sheet is still in one connected piece.

As it turns out, 5 is the maximum number of stamps that can be cut. Now Leon has a 9×9 sheet of stamps. What is the maximum number of stamps that can be cut if the same three conditions must be satisfied? Give a method for cutting that many stamps, and a proof that no larger number of stamps can be cut.

	X		X	
		X		
	X		X	

ANSWER：＿＿＿＿＿ stamps