International Mathematics Assessments for Schools

2012 JUNIOR DIVISION FIRST ROUND PAPER

Time allowed：75 minutes

INSTRUCTION AND INFORMATION

GENERAL

1. Do not open the booklet until told to do so by your teacher.
2. No calculators, slide rules, log tables, math stencils, mobile phones or other calculating aids are permitted. Scribbling paper, graph paper, ruler and compasses are permitted, but are not essential.
3. Diagrams are NOT drawn to scale. They are intended only as aids.
4. There are 20 multiple-choice questions, each with 5 choices. Choose the most reasonable answer. The last 5 questions require whole number answers between 000 and 999 inclusive. The questions generally get harder as you work through the paper. There is no penalty for an incorrect response.
5. This is a mathematics assessment, not a test; do not expect to answer all questions.
6. Read the instructions on the answer sheet carefully. Ensure your name, school name and school year are filled in. It is your responsibility that the Answer Sheet is correctly coded.
7. When your teacher gives the signal, begin working on the problems.

THE ANSWER SHEET

1. Use only lead pencils.
2. Record your answers on the reverse side of the Answer Sheet (not on the question paper) by FULLY filling in the circles which correspond to your choices.
3. Your Answer Sheet will be read by a machine. The machine will see all markings even if they are in the wrong places. So please be careful not to doodle or write anything extra on the Answer Sheet. If you want to change an answer or remove any marks, use a plastic eraser and be sure to remove all marks and smudges.

INTEGRITY OF THE COMPETITION

The IMAS reserves the right to re-examine students before deciding whether to grant official status to their scores..

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Questions 1-10, 3 marks each

1. What is the value of $2012^0 + (-1)^2 + |-2012|$?

（A）–2010　（B）1　（C）2012　（D）2013　（E）2014

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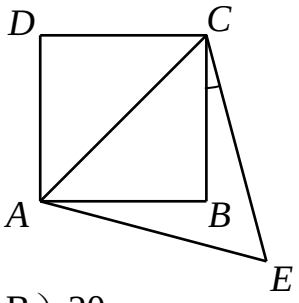
2. In the diagram below, *ABCD* is a square and *ACE* is an equilateral triangle. What is the measure, in degrees, of $\angle BCE$?



（A）15　（B）20　（C）25
（D）30　（E）cannot be determined

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3. The smallest interior angle of a triangle is 50°. Which of the following statements about this triangle is correct?

（A）It must be isosceles.　（B）It must be right angled.
（C）It must be acute angled.　（D）It must be obtuse angled.
（E）None of these is correct.

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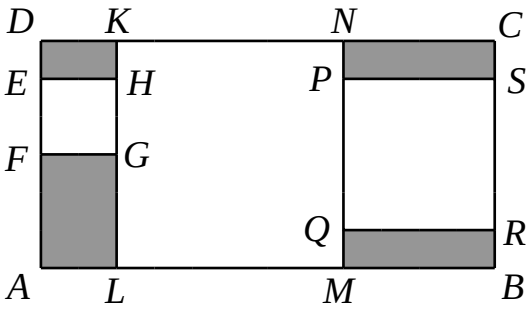
4. The diagram to the below shows three squares *EFGH*, *KLMN* and *PQRS* inside a rectangle *ABCD*. The areas of the three squares are 1 cm^2, 9 cm^2 and 4 cm^2 respectively. What is the sum of areas of the shaded regions in cm^2?



（A）3　（B）4　（C）5　（D）6　（E）7

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5. A triangle is formed with 10 matchsticks of equal length connected end to end. No matchsticks are bent or broken. How many different triangles can be formed?

（A）2　（B）3　（C）4　（D）5　（E）6

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6. A piece of paper in the shape of parallelogram is folded into two with the crease bisecting the area of parallelogram. How many different kinds of origami methods are possible?

（A）0　　（B）1　　（C）2

（D）3　　（E）infinitely many

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7. A TV company plans to broadcast a series with 48 episodes. One episode is aired each day except on Saturday and Sunday. If the first episode is aired on Thursday, on what day of the week will the last episode be aired?

（A）Monday　（B）Tuesday　（C）Wednesday（D）Thursday（E）Friday

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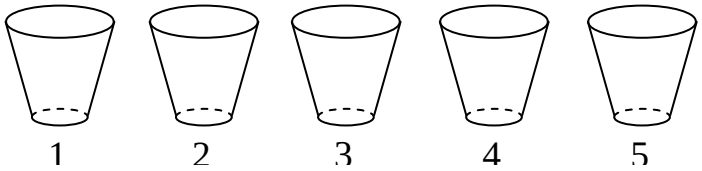
8. Cups labelled 1, 2, 3, 4 and 5 with mouth upwards line in row, as shown below. Initially a ball is put into cup #3. In each move, the ball is transferred to an adjacent cup. If the ball is in cup #1, it can only be moved to cup #2. If the ball is in cup #5, it can only be moved to cup #4. After $2^{10}+3^{8}$ moves, which of the following statements about the ball is correct?



（A）It cannot be in cup #3, cannot be in cup #4 and cannot be in cup #5

（B）It cannot be in cup #2, cannot be in cup #4 and cannot be in cup #5

（C）It cannot be in cup #1, cannot be in cup #4 and cannot be in cup #5

（D）It cannot be in cup #1, cannot be in cup #3 and cannot be in cup #5

（E）It cannot be in cup #2 and cannot be in cup #4

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9. During the holidays, Dick worked part-time washing bowls in a restaurant. He got paid 3 dollars for washing one bowl. If he broke a bowl, he got no pay for washing it, and must pay 9 dollars to the owner. In one week, Dick washed 500 bowls and earned 1368 dollars. How many bowls did he break?

（A）7　　（B）8　　（C）9　　（D）10　　（E）11

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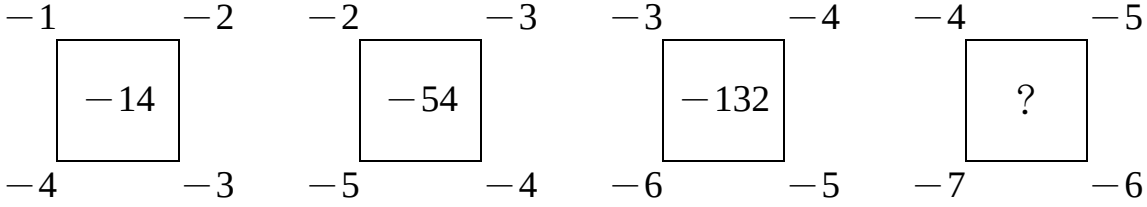
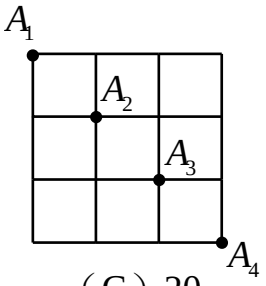
10. The diagram below shows four squares with numbers which exhibit a certain pattern. What number should be inside the fourth box?



（A）−210　（B）−260　（C）−288　（D）−308　（E）−330

Questions 11-20, 4 marks each

11. The diagram below shows a square network of roads, A_1, A_2, A_3 and A_4 are four intersections on the same diagonal. We want to go from A_1 to A_4 by going only to the east or to the south, without passing through A_3. How many different paths are there?



(A) 8 (B) 10 (C) 20 (D) 15 (E) 12

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12. Each row in a cinema has 80 seats, and row 13 to row 24 are reserved for students from a secondary school. There are 15 empty seats in these rows when all the students have taken their seats. How many secondary school students went to the cinema?

(A) 945 (B) 875 (C) 865 (D) 775 (E) 765

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13. The total weight of 3 apples is equal to that of 4 bananas, and the total weight of 5 bananas is equal to that of 6 oranges. How many apples have the same total weight as 16 oranges?

(A) 6 (B) 7 (C) 8 (D) 9 (E) 10

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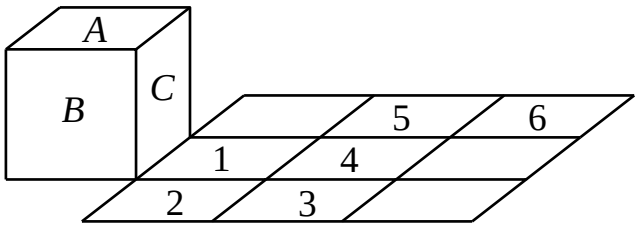
14. The diagram below shows a cube with three of its faces labelled A, B and C, and a 3×3 square with six of its squares labelled 1, 2, 3, 4, 5 and 6. The cube is tipped over so that face C lies on square 1, tipped over again so that face B lies on square 2, and so on until the cube lies on square 6. What is the sum of the numbers of the squares on which the cube has laid with face B on top?



(A) 2 (B) 6 (C) 7 (D) 9 (E) 10

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15. A deck of 54 cards has 2 jokers, and 13 cards of each of spades, hearts, clubs and diamonds. At least how many cards should be drawn at random so that there are at least 4 cards of the same suit?

(A) 54 (B) 14 (C) 15 (D) 16 (E) 17

16. The number $5^n + 7^n$ is divided by 100 where n is any non-negative integer. How many different values of the remainder are there?

（A）4　　（B）6　　（C）8　　（D）10　　（E）15

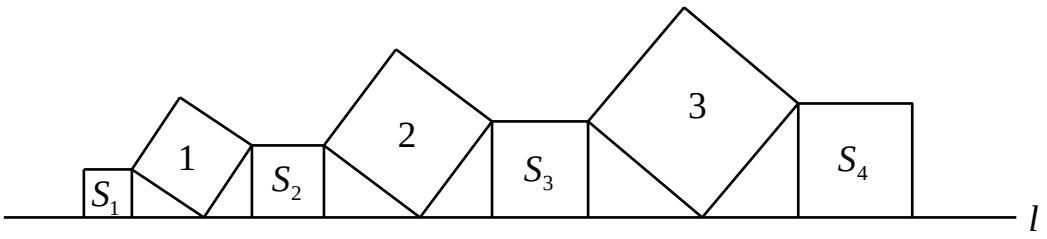
17. For any positive integers a and b, define a new operation $a \odot b$ which yields the remainder when the larger of a and b is divided by the smaller one. For example, $5 \odot 12 = 12 \odot 5 = 2$. Given that $(19 \odot x) \odot 19 = 5$, what value below is not possible for x?

（A）12　　（B）26　　（C）33　　（D）39　　（E）45

18. What is the total number of positive integers consisting of three different digits in which the tens digit is equal to the units digit of the sum of the other two digits?

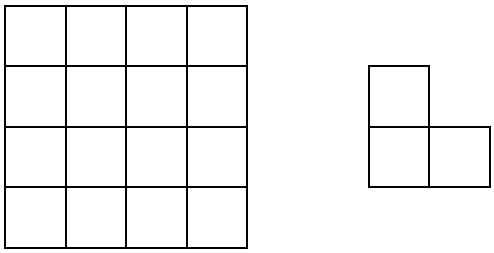
（A）36　　（B）60　　（C）72　　（D）90　　（E）108

19. The diagram below shows seven squares resting on a straight line. The areas of three tilted squares are 1, 2 and 3. What is the total area of the other four squares?



（A）4　　（B）5　　（C）6　　（D）7　　（E）8

20. On a 4×4 chessboard shown in the diagram below on the left, we wish to place a minimum number of copies of the shape shown in the diagram below on the right, so that no more copies of this shape can be placed. Copies may be rotated. What is this minimum number of copies?



（A）2　　（B）3　　（C）4　　（D）5　　（E）6

Questions 21-25, 6 marks each

21. We place 100 table tennis balls inside *n* boxes so that the number of balls in each box contains the digit 8, such as 8 balls, 18 balls, 83 balls and 88 balls. When *n*=3, the number of table tennis balls in the boxes are 8, 8 and 84 respectively. If *n* = 5, and two of the boxes have the same number of balls while other boxes have different number of balls, what is the largest total number of balls in two boxes?

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22. Let *a*, *b*, *c* and *d* be positive integers less than 10, and *x* be an integer such that $ax^3 - bx^2 - cx - d = 0$. What is maximum value of *x*?

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23. Let *a*, *b* and *c* be real numbers such that $a + b + c = 0$ and $abc = -15$.

    What is the value of $a^2(b + c) + b^2(c + a) + c^2(a + b)$?

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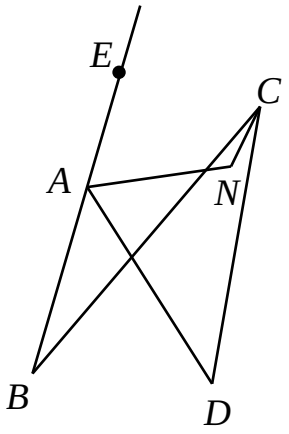
24. The diagram below shows four line segments *AB*, *BC*, *CD* and *DA* on the plane where $\angle ABC = 24°$ and $\angle ADC = 42°$. Point *E* is on the extension of line *BA*, and the angle bisectors of $\angle DAE$ and $\angle BCD$ intersects at point *N*. What is the measure, in degrees, of $\angle ANC$?



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25. In the expression 6□7□8□9, an arithmetic sign (plus, minus, multiplication or division sign, can be used with repetition) is placed in each bracket □. Open bracket is allowed (it is optional). What will be the largest 3- digit number obtained?

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