International Mathematics Assessments for Schools

2014 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 $2014-1^{204}+\sqrt{(-2014)^2}$?

（A） 1　　（B） –1　　（C） –2087
（D） 4027　　（E） 4029

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2. A compass costs 15.40 dollars and a ruler costs 8.65 dollars. How many more dollars does the compass cost than the ruler?

（A） 7.25 dollars　　（B） 7.75 dollars　　（C） 24.05 dollars
（D） 6.25 dollars　　（E） 6.75 dollars

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3. The two stars in the diagram represent the same number. The sum of the three numbers in the second row is equal to twice the sum of the three numbers in the first row. What number does each star represent?

5	6	☆		
		☆	19	20

（A） 7　　（B） 8　　（C） 13　　（D） 17　　（E） 18

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4. In a restaurant, one cup of tea and two cups of coffee cost 78 dollars, while three cups of tea and one cup of coffee cost 94 dollars. How many more dollars does a cup of coffee cost than a cup of tea?

（A） 2　　（B） 4　　（C） 6　　（D） 10　　（E） 12

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5. When two numbers are divided by 5, the respective remainders are 4 and 2. What is the remainder when the sum of the two numbers is divided by 5?

（A） 0　　（B） 1　　（C） 2　　（D） 3　　（E） 4

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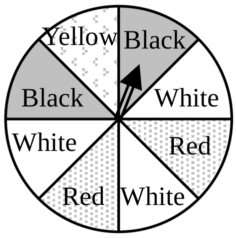
6. A circular spinner is divided into eight equal sectors. Two of them are painted red, two black, three white and one yellow. What is the probability for the pointer of the spinner to be pointing at a black sector?



（A） $\frac{3}{4}$　　（B） $\frac{1}{4}$　　（C） $\frac{3}{8}$　　（D） $\frac{1}{8}$　　（E） $\frac{1}{2}$

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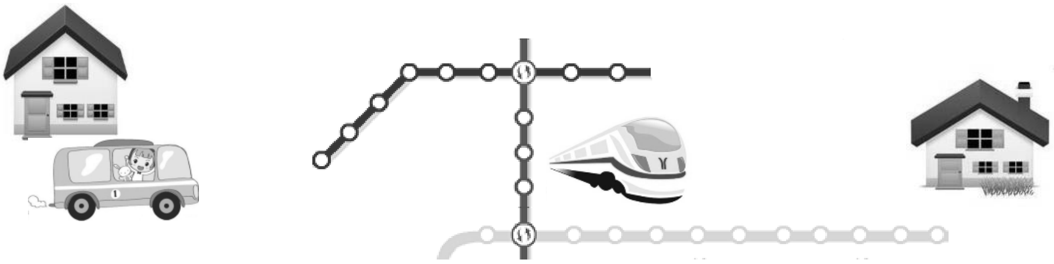
7. To visit a friend, Rod must take the bus to the nearest Metro station, and this takes 15 minutes. He has to ride the Metro train for 20 stops, each taking 2.5 minutes. He also has to change trains twice, and it takes 3 minutes each time. Finally, after exiting the Metro, he still has to walk another 12 minutes before reaching his friend’s place. How many minutes does Rod have to spend traveling to his friend’s house?



(A) 55　(B) 67　(C) 80　(D) 83　(E) 90

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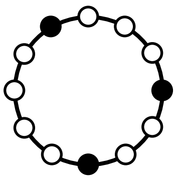
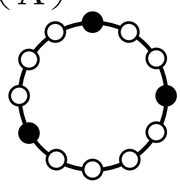
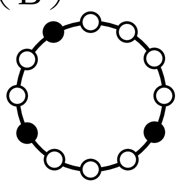
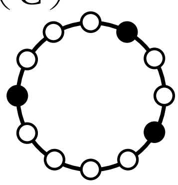
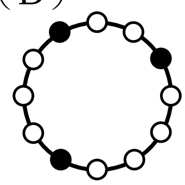
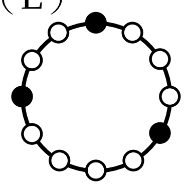
8. On a table there is a ring, there are 12 equally spaced beads on the ring, 3 of which are black, as shown in the diagram. Which of the following five figures cannot be obtained from the given figure by rotating the ring on the table?



(A) 
(B) 
(C) 
(D) 
(E) 

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9. If a, x and y are real numbers such that $|2y-12|+\sqrt{ax-y}=0$, what is the value of the product axy?

(A) 0　(B) 6　(C) 12
(D) 36　(E) impossible to determine

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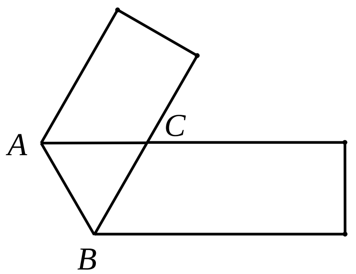
10. How many integers a satisfies $|2a+7|+|2a-1|=8$?

(A) 9　(B) 8　(C) 5　(D) 4　(E) infinite

Questions 11-20, 4 marks each

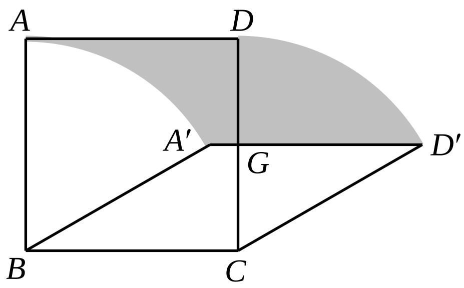
11. If a and b are prime numbers such that $a^2-7b-4=0$, what is the value of a+b?
（A）5 （B）8 （C）9 （D）10 （E）13

12. The diagram shows a strip of paper folded along the segment AB. If $\angle ACB=60°$ and the area of triangle ABC is $\sqrt{3}\,\text{cm}^2$, what is the width, in cm, of this strip?



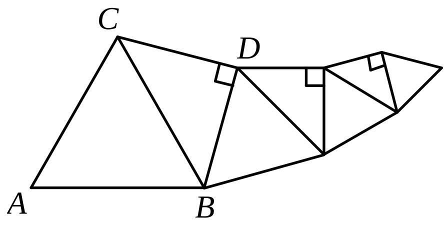
（A）1 （B）$\sqrt{3}$ （C）$\frac{\sqrt{3}}{2}$
（D）$\frac{2\sqrt{3}}{3}$ （E）impossible to determine

13. $ABCD$ is a square of side length 10 cm. The segment BC is fixed. The segment AD moves in the plane to the segment $A'D'$ so that the lengths AB, DC and AD do not change. What is the area, in cm^2, of the shaded region in the diagram when the segment $A'D'$ intersects the segment CD at its midpoint G?



（A）50 （B）$\frac{50\pi}{3}$ （C）60 （D）100 （E）$\frac{100\pi}{3}$

14. We start with an equilateral triangle ABC of area 80 cm^2. We construct a right isosceles triangle BCD using BC as the hypotenuse. Then we construct an equilateral triangle using BD as a side. This continued alternately, as shown in the diagram. What is the area, in cm^2, of the fourth equilateral triangle?

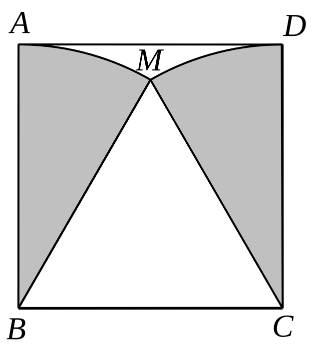


(A) 1.25 (B) 5 (C) 6.4 (D) 10 (E) 40

15. We wish to spend 100 dollars to buy 18 stamps, each costing 4 dollars, 8 dollars or 10 dollars. We must buy at least 1 stamp of each of the three kinds. How many different ways can the buying of stamps be possible?

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

16. The sectors MAB and MCD are inside the square $ABCD$ of side length 10 cm, as shown in the diagram. What is the total area, in cm^2, of these two sectors, correct to 1 decimal place? Take π=3.14.



(A) 52.3 (B) 78.5 (C) 104.7 (D) 157.0 (E) 314.0

17. Three different positive integers m, n and p are such that

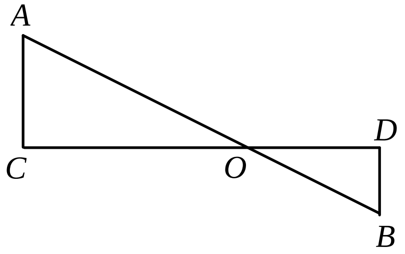
$(m-3)(n-3)(p-3)=4$. What is the value of $m + n + p$?

(A) 5 (B) 6 (C) 8 (D) 14 (E) 15

18. If $x<y<0$ and $x^2+y^2=4xy$, what is the value of $\frac{x+y}{x-y}$?

(A) $\sqrt{3}$ (B) $-\sqrt{3}$ (C) 3 (D) $\sqrt{6}$ (E) $-\sqrt{6}$

19. The diagram shows two right triangles *OAC* and *OBD*. The lengths of three of the segments *AB*, *AC*, *CD* and *DB* are 12 cm, 6 cm and 3 cm. What is the number of possible lengths, in cm, of the fourth segment?



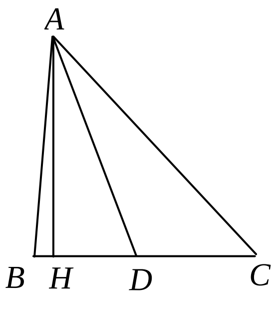
(A) 2 (B) 3 (C) 4 (D) 5 (E) 6

20. For any real number *x*, we denote by [*x*] the greatest integer not greater than *x*. For example, $[\pi]=3$ and $[-\pi]=-4$. How many positive integers *n* satisfy $\left[\dfrac{\left[\dfrac{100}{n}\right]}{n}\right]=1$?

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

Questions 21-25, 6 marks each

21. In the diagram, *AH* is perpendicular to *BC*, *AB* = *BC* < *AC*, and *AD* is the bisector $\angle BAC$. If $\angle DAH = 21°$, what is the measure, in degrees, of $\angle BAC$?



22. How many four-digit numbers are divisible by all of 2, 3, 4, 5, 6, 7 and 8?

23. Each of *A*, *B*, *C* and *D* has some apples. *A* has as many apples as the other three together. *B* has half as many apples as the other three together. *C* has one-sixth as many apples as the other three together. How many times *D*'s number of apples will be equal to total number of apples of *A*, *B* and *C*?

24. In how many ways can 31 be expressed in the form $a + b + c$ $(a \leq b \leq c)$, where a, b and c are prime numbers?

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25. Each of the three dimensions of a cuboid of volume x cm^3 is an integral number of cm. The box is placed on a table. The total surface area of the five visible faces is x cm^2. Find the minimum value of x.

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