International Mathematics Assessments for Schools

2011 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 possible answers given and 5 questions that require a whole number answer between 0 and 999. 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 pencil.
2. Record your answers on the reverse of the Answer Sheet (not on the question paper) by FULLY colouring the circle matching your answer.
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 score.

2011 JUNIOR DIVISION FIRST ROUND PAPER

Questions 1-10, 3 marks each

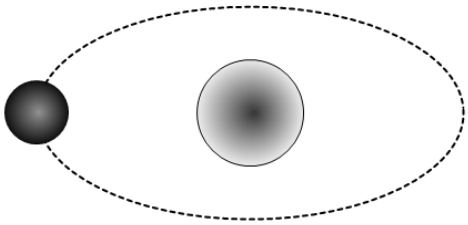
1. What is $2011+1102\times(1-3)$?

（A）193　　（B）4215　　（C）6226　　（D）−193　　（E）−6226

2. Which number is the largest?

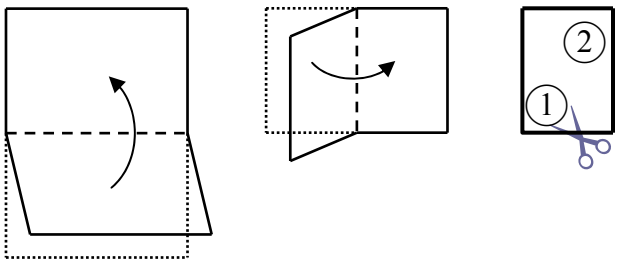
（A）3.14　　（B）π　　（C）$\frac{22}{7}$　　（D）3.135　　（E）304%

3. The temperature on the shady side of a certain planet is −253°C. The temperature on its sunny side is only −223°C. Which of the following statement is an accurate description of the relation between the temperatures on the shady side and on the sunny side?



（A）The temperature of its sunny side is 30°C higher than its shady side;
（B）The temperature of its sunny side is 30°C lower than its shady side;
（C）The temperature of its sunny side is 476°C higher than its shady side;
（D）The temperature of its sunny side is 476°C lower than its shady side;
（E）The temperature of its sunny side is the same as its shady side.

4. The given diagram shows a rectangular piece of paper folded in quarters along two perpendicular folds. If a cut is made around the corner marked 1, which of the following **cannot** possibly be the shape of the resulting hole in the piece of paper?



（A）Octagon　（B）Quadrilateral（C）Hexagon（D）Triangle（E）Circle

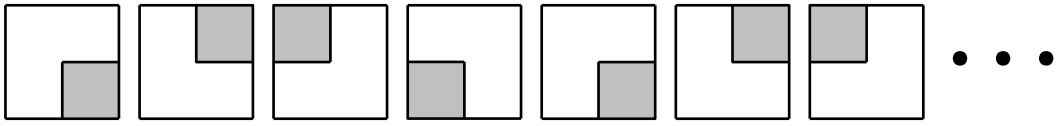
5. Around 550 BC, the Greek mathematician Pythagoras discovered and proved a theorem which now bears his name. To celebrate this achievement, he had 100 cows killed for a feast. Thus the result is also known as the One Hundred Cows Theorem. What is the anniversary of this result in 2011? (There is no Year 0.)

（A）2562　　（B）2560　　（C）2561　　（D）1460　　（E）1461

6. A rectangle is 6 cm by 8 cm. It is revolved about an axis on the rectangle itself. What is the number of different cylinders that may be obtained in this way?

(A) 2 (B) 4 (C) 6 (D) 8 (E) Infinity

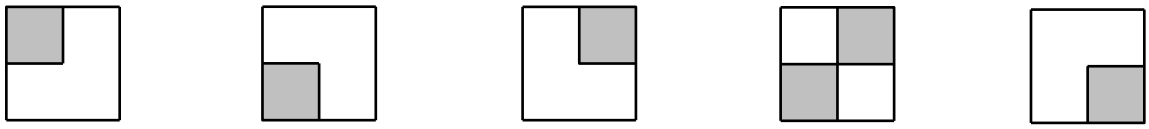
7. There is a pattern to the given sequence of figures:



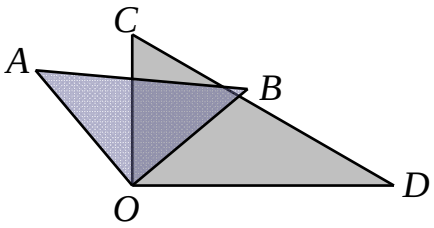
(1) (2) (3) (4) (5) (6) (7)

Which of the following will be the 2011-th figure of the sequence?

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



8. The given diagram shows two overlapping right triangles having a common vertex O. If $\angle AOD = 123°$, what is the measure, in degrees, of $\angle BOC$?

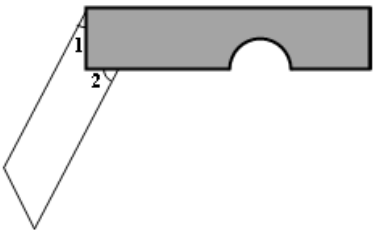


(A) 33 (B) 53
(C) 57 (D) 60
(E) 66

9. A greengrocer is having an apple sale. The price is \$6 per kilogram. If the total purchase exceeds 3 kilograms, a 20% discount is applied to the portion over 3 kilograms. There is no discount if the total purchase does not exceed 3 kilograms. If Leith buys 8 kilograms of apples from this greengrocer, how much does he pay?

(A) \$32 (B) \$36 (C) \$42 (D) \$44 (E) \$21

10. The given diagram shows a pocket knife. The shaded part is a rectangle with a small semicircular indentation. The two edges of the blade are parallel, forming angles 1 and 2 with the shaft as shown. What is the measure, in degrees, of $\angle 1 + \angle 2$?



(A) 30 (B) 45 (C) 60
(D) 90 (E) could not be determined

Questions 11-20, 4 marks each

11. The given diagram shows the projected sale and actual sale of a certain toy company for the fourth quarter of the year. The achievement percentage is equal to $\frac{\text{actual sale}}{\text{projected sale}} \times 100\%$. What is this achievement percentage?

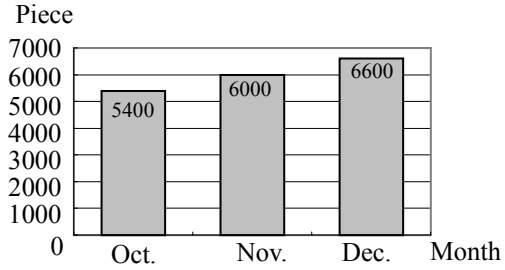


Fig. A Projected sale

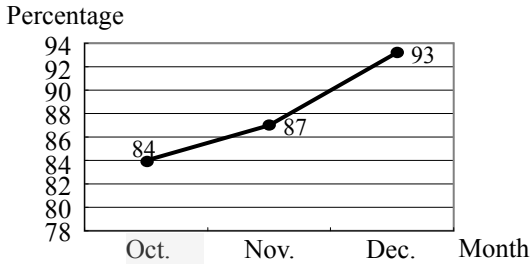
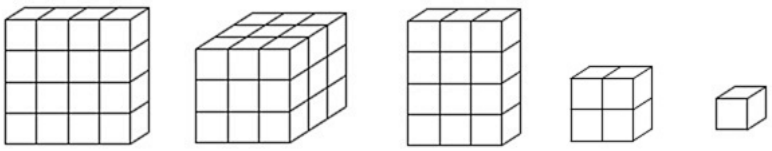


Fig. B Actual sale

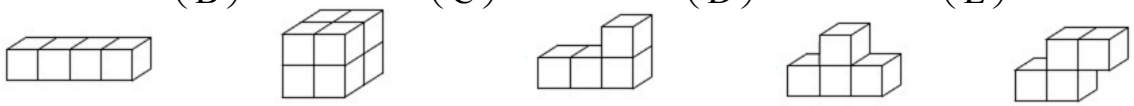
(A) 86% (B) 88.3% (C) 88% (D) 86.3% (E) 90.3%

12. Leon is given five wooden blocks:

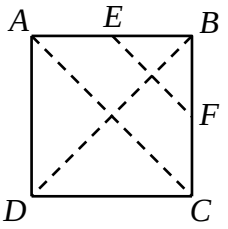


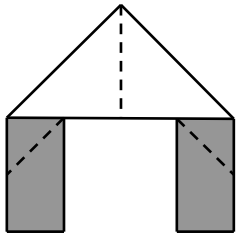
Which of the following blocks should be added so that he can make a 4×4×4 cube? (None of the blocks can be dissected)

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



13. The given diagram shows how a square *ABCD* with side length 40 may be dissected into six pieces by three straight cuts *AC*, *BD* and *EF*, where *E* and *F* are the respective midpoints of *AB* and *BC*. The pieces are then rearranged to form the given shape. What is the total area, in square centimetres, of the shaded part of the given shape?





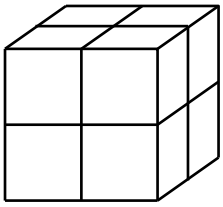
(A) 200 (B) 400 (C) 600 (D) 800 (E) 1000

14. The given diagram shows the calendar for the month of November, 2011. Three numbers from the same column are chosen. Of the following number, which can be the sum of three such numbers?

NOVEMBER 2011						
SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

（A）21　　（B）37　　（C）38
（D）40　　（E）54

15. The given diagram shows a large cube formed of eight identical small cubes. The surface area of the large cube is 216 square centimetres less than the total surface areas of the eight small cubes. What is the length, in centimetres, of a side of a small cube?

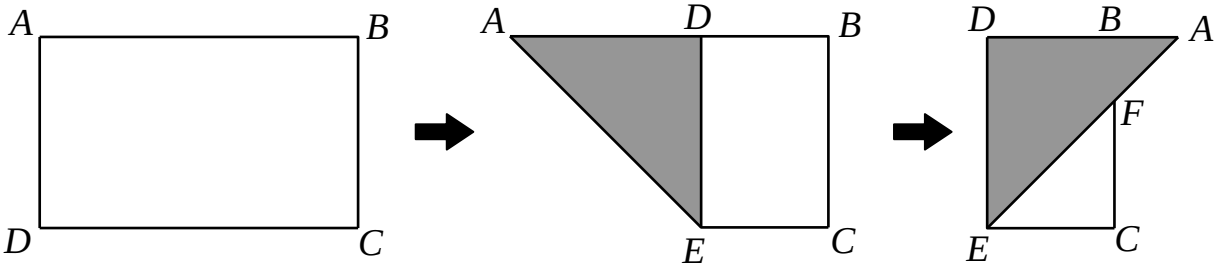


（A）2　　（B）3　　（C）4
（D）5　　（E）6

16. In an NBA basketball game, a player scores 44 points, 5 of which come from 5 foul shots (each shot scores 1 point). He makes more 2-point shots than 3-point shots. Of the following number, which **cannot** possibly be the total number of 2-point and 3-point shots made by this player?

（A）15　　（B）16　　（C）17　　（D）18　　（E）19

17. The given diagram shows a rectangle *ABCD* being folded along a straight segment *AE* with *E* on *CD*, so that the new position of *D* is on *AB*. Triangle *ADE* is then folded along *DE* so that the new position of *A* is on the extension of *DB*. The new position of *AE* intersects *BC* at *F*. If *AB* = 10 centimetres and *AD* = 6 centimetres, what is the area, in square centimetres, of triangle *ABF*?



（A）2　　（B）4　　（C）6　　（D）8　　（E）10

18. A child is operating a remote-controlled car on a flat surface. Starting from the child's feet, the car moves forward 1 metre, makes a 30° turn counterclockwise, moves forward 1 metre, makes a 30° turn counterclockwise, and so on. When the car first time returns to its starting point for the first time, what is the total distance, in metres, that it has covered?

（A）4　　（B）8　　（C）12　　（D）16　　（E）24

19. Each interior angle of a regular convex polygon is greater than 100° and less than 140°. Of the following numbers, which **cannot** possibly be the number of sides of this polygon?

(A) 5 (B) 6 (C) 7 (D) 8 (E) 9

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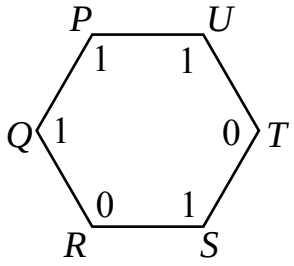
20. In the given diagram, each vertex of the hexagon *PQRSTU* is labeled with 0 or 1. Starting counterclockwise from a vertex, he multiplies the labels by 3, 7, 15, 31, 63 and 127 respectively and add the six products. If the starting point is *P*, the final sum is $1\times3+1\times7+0\times15+1\times31+0\times63+1\times127=168$. What is the starting point if the final sum is 180?



(A) *Q* (B) *R* (C) *S* (D) *T* (E) *U*

Questions 21-25, 6 marks each

21. A drunk walks 1 metre east. Then he stops, makes a 90° turn clockwise or counterclockwise and walks 2 metres. Then he stops, makes a 90° turn clockwise or counterclockwise and walks 3 metres. He continues in this pattern, stopping, making 90° turn clockwise or counterclockwise and walks 1 metre more than the preceding segment. What would be the longest distance, in metres, between his initial position and his position when he makes his seventh stop?

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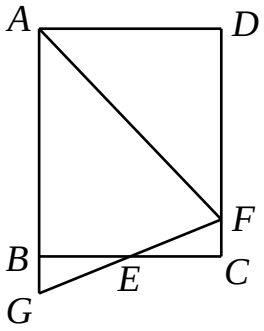
22. In the given diagram, *ABCD* is a rectangle with *AB* = 25 cm and *BC* = 20 cm. *F* is a point on *CD* and *G* is a point on the extension of *AB* such that *FG* passes through the midpoint *E* of *BC*. If $\angle AFE = \angle CFE$, what is the length, in cm, of *CF*?



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23. Consider all five-digit numbers using each of the digits 1, 2, 3, 4 and 5 exactly once, possibly with a decimal point somewhere. Starting with the smallest such number, namely, 1.2345, they are listed in ascending order. What is 1000 times the difference of the 150th and the 145th numbers?

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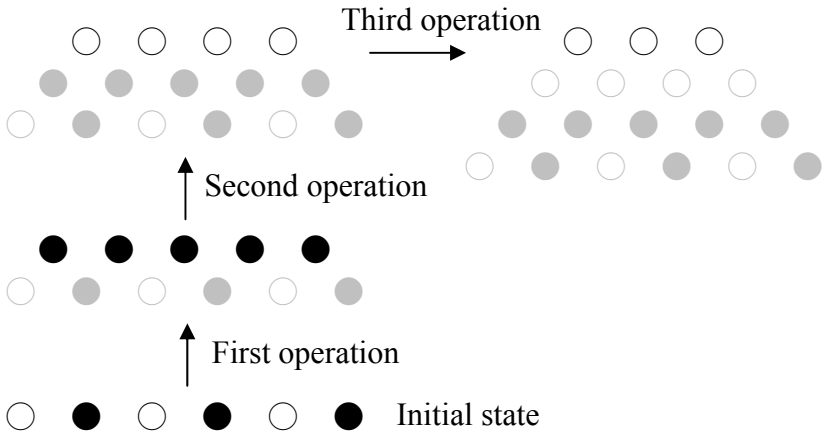
24. In a row are six counters, each either black or white. Between every two adjacent counters, we place a new counter. If the two adjacent counters are of the same colour, we place a white counter. If they are of different colours, we place a black counter. Then we remove the original six counters, leaving behind a row of five counters. We now repeat this operation two more times, reducing the number of counters in the row to four and then to three. If the last three counters are all white, how many different colour patterns for the original six counters are there? An example is attached.



25. Mickey lives in a city with six subway lines. Every two lines have exactly one common stop for changing lines, and no three lines meet at a common stop. His home is not at one of the common stops. One day, Mickey suddenly decides to leave home and travel on the subway, changing trains at least once at each stop before returning home. What is the minimum number of changes he has to make to accomplish this task?