International Mathematics Assessments for Schools

2015 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 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.

2015 JUNIOR DIVISION FIRST ROUND PAPER

Questions 1-10, 3 marks each

1. What is the value of $\sqrt{(-2)^8}+(1+2+2^2+\cdots+2^{2015})^0+|-16|$?

(A) 0 (B) 32 (C) 33
(D) $2^{2016}-1$ (E) $2^{2016}+31$

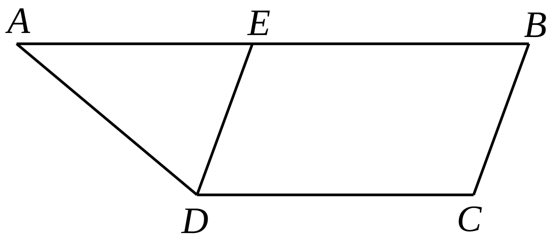
---

2. Someone set the alarm clock for 1:30 pm and fell asleep at 12:35 pm. When he was awaken by the alarm clock, for how long had this person been sleeping?

(A) 1hour and 5 minutes (B) 55 minutes (C) 95 minutes
(D) 105 minutes (E) 11 hours and 5 minutes

---

3. In a quadrilateral $ABCD$, $AB // DC$, $BC // ED$, $AD = AE$ and $\angle C = 110°$. What is the measure of $\angle A$?



(A) 20° (B) 35° (C) 40° (D) 55° (E) 70°

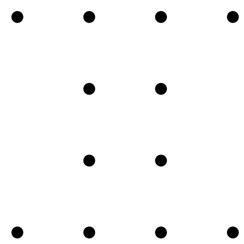
---

4. In a sale, each dress is reduced to 49% of its price and if two dresses are purchased at the same time, both are reduced to 45% of their prices. Lily buys two dresses together and pays 90 dollars for both. By doing this instead of buying them separately, how many dollars has she saved?

(A) 10 (B) 8 (C) 6 (D) 4 (E) 3.6

---

5. Sixteen points are arranged in a 3 cm by 3 cm formation. Four of them are removed, leaving behind twelve points as shown in the diagram. If we choose three of these twelve points as vertices of a triangle, what is the largest possible area of this triangle, in cm^2?



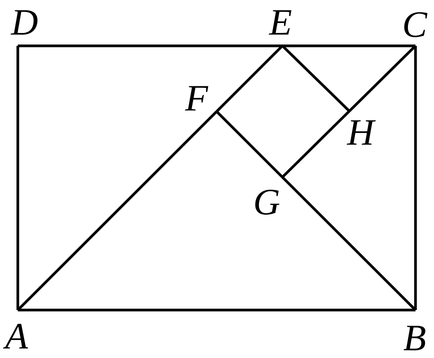
(A) 9 (B) $\frac{9}{2}$ (C) 3 (D) 2 (E) $\frac{3}{2}$

---

6. Class A has 17 students more than Class B, which has 15 students less than Class C. Of the following five numbers, which can be the total number of students in these three classes?
（A）150 （B）151 （C）152 （D）153 （E）154

7. From 0, 1, 2, 3, 4 and 5, we choose two different numbers x and y. What is the largest possible value of $2(x+y)^2+(x-y)^2$?
（A）75 （B）163 （C）175 （D）187 （E）200

8. Divide the rectangle *ABCD* into four isosceles right triangles and one square, as in the diagram below. If the area of square *EFGH* is 100 cm^2, what is the area of rectangle *ABCD*, in cm^2?



（A）750 （B）1000 （C）1100 （D）1200 （E）1600

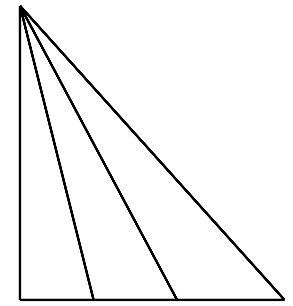
9. A group of students are staying in a hotel. If five of them share a room, then there is no room for six of them. If six of them share a room, there are just enough rooms, one of which has less than six students. Of the following five numbers, which cannot be the number of students?
（A）46 （B）51 （C）56 （D）61 （E）66

10. In a pentagon, one angle is $48°$. The second angle is three times as large as the first. The third angle is $30°$ less than the second. The fourth angle is $10°$ less than the fifth. What is the measure of the fourth angle, in degrees?
（A）112 （B）122 （C）132 （D）142 （E）152

Questions 11-20, 4 marks each

11. There are three shirts, three pairs of trousers and three pairs of shoes. Of each type, one is red, one is black and one is white. In how many different ways can we choose one of each type so that something white is chosen?
（A）8 （B）9 （C）18 （D）19 （E）27

12. In triangle *ABC*, *AB* is perpendicular to *BC*. *D* and *E* are points on *BC* such that $\angle BAD=\angle DAE=\angle EAC$ and $\angle ADC-\angle C=56^\circ$. What is the measure of $\angle BAC$?

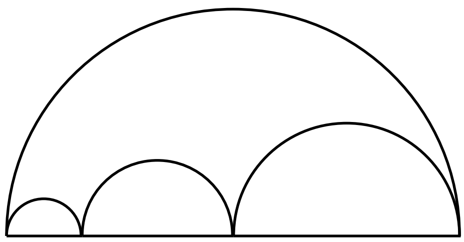


（A）42°　（B）45°　（C）51°　（D）60°　（E）84°

13. If $\frac{a}{b}=a+1$ and $\frac{b}{a}=a-1$, what is the value of $\frac{b^2}{(a-1)^2}$?

（A）1　（B）2　（C）3　（D）4　（E）5

14. *C* and *D* are points on *AB* such that *AC* : *CD* : *DB* = 1 : 2 : 3. Semicircles are drawn on the same side of *AB* with respective diameters *AB*, *AC*, *CD* and *DB*. What fraction of the area of the largest semicircle is the total area of the other three semicircles?

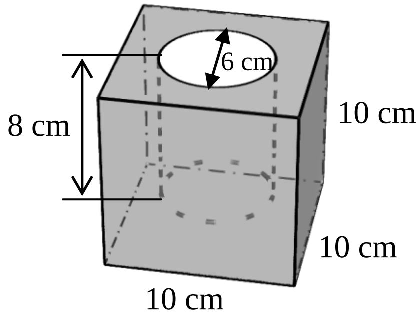


（A）$\frac{1}{4}$　（B）$\frac{1}{3}$　（C）$\frac{13}{36}$　（D）$\frac{7}{12}$　（E）$\frac{7}{18}$

15. Each coin is worth either 1 dollar, 5 dollars or 10 dollars. Their total worth is 60 dollars. They may be divided into three, four or five piles of equal worth. What is the minimum number of coins?

（A）6　（B）11　（C）15　（D）16　（E）20

16. From a cube of side length 10 cm, a cylinder with diameter 6 cm and depth 8 cm is hollowed out. What is the volume, in cm^3, of the remaining part of the cube? Take π=3.14.

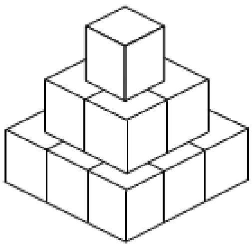


（A）426.08　（B）517.46　（C）573.94　（D）717.46　（E）773.92

17. If a, b and c are all positive integers, which of the following numbers can be the value of $(a+b+c)(a+b-c)(a-b+c)(-a+b+c)$?

（A）44　（B）46　（C）48　（D）50　（E）52

18. A three-layer structure consists of 14 unit cubes. The bottom layer consists of 9 cubes in a 3 by 3 configuration. The middle layer consists of 4 cubes in a 2 by 2 configuration. The top layer consists of a single cube. The exposed surface area of this structure is painted, including the bottom. What is the total area of the unpainted surface of the individual cubes?



（A）20　（B）31　（C）42　（D）53　（E）64

19. In an election between four candidates, they are supported respectively by 11, 12, 13 and 14 of the first 50 voters. Six more votes are to be cast, each for one of the four candidates. In how many ways can the candidate currently with 13 supporters become the uncontested winner?

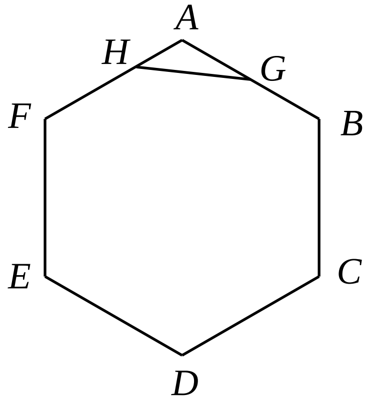
（A）16　（B）17　（C）18　（D）19　（E）20

20. Let x, y and z be distinct positive prime numbers such that $x+y+z$ and $x^2+y^2+z^2$ are also prime numbers. What is the minimum value of $x+y+z$?

（A）17　（B）19　（C）23　（D）29　（E）31

Questions 21-25, 6 marks each

21. *ABCDEF* is a regular hexagon. *G* is the midpoint of *AB* and *H* is the point on *AF* such that *FH*=2*AH*. If the area of triangle *AHG* is 1 cm^2. What is the area, in cm^2, of *ABCDEF*?



22. What is the value of *abc* where *a*, *b* and *c* are positive real numbers such that $a(b+c)=48$, $b(c+a)=70$ and $c(a+b)=88$?

23. What is the value of b^a where *a* and *b* are real numbers such that $b=\sqrt{a^2-6a+b}+|b-9|+9$?

24. What is the maximum value of *a* if $a^2 \mid (10\times 11\times 12\times\cdots\times 19)$?

25. For any permutation of 1, 2, 3, 4, 5, 6, 7 and 8, add the second number to the first, multiply the sum by the third number, add the fourth number to the product, multiply the sum by the fifth number, and so on. What is the minimum value of the final sum?

***