



# International Junior Math Olympiad

## GRADE 7

**Time Allowed:** 90 minutes

Name:

Country:

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### INSTRUCTIONS

1. Please DO NOT OPEN the contest booklet until told to do so.
2. There are 30 questions.  
*Section A:* Questions 1 to 10 score 2 points each, no points are deducted for unanswered question and 1 point is deducted for wrong answer.  
*Section B:* Questions 11 to 20 score 3 points each, no points are deducted for unanswered question and 1 point is deducted for wrong answer.  
*Section C:* Questions 21 to 30 score 5 points each, no points are deducted for unanswered or wrong answer.
3. Shade your answers neatly using a 2B pencil in the Answer Entry Sheet.
4. No one may help any student in any way during the contest.
5. No electronic devices capable of storing and displaying visual information is allowed during the exam. Strictly NO CALCULATORS are allowed into the exam.
6. No exam papers and written notes can be taken out by any contestant.



**SECTION A** – 10 questions

**Question 1**

The value of  $\frac{1}{2 - \frac{1}{2 - \frac{1}{2 - \frac{1}{2 - \frac{1}{2}}}}}$  is equal to \_\_\_\_\_.

- A.  $\frac{3}{4}$
- B.  $\frac{4}{5}$
- C.  $\frac{5}{6}$
- D.  $\frac{6}{7}$
- E.  $\frac{7}{8}$

**Question 2**

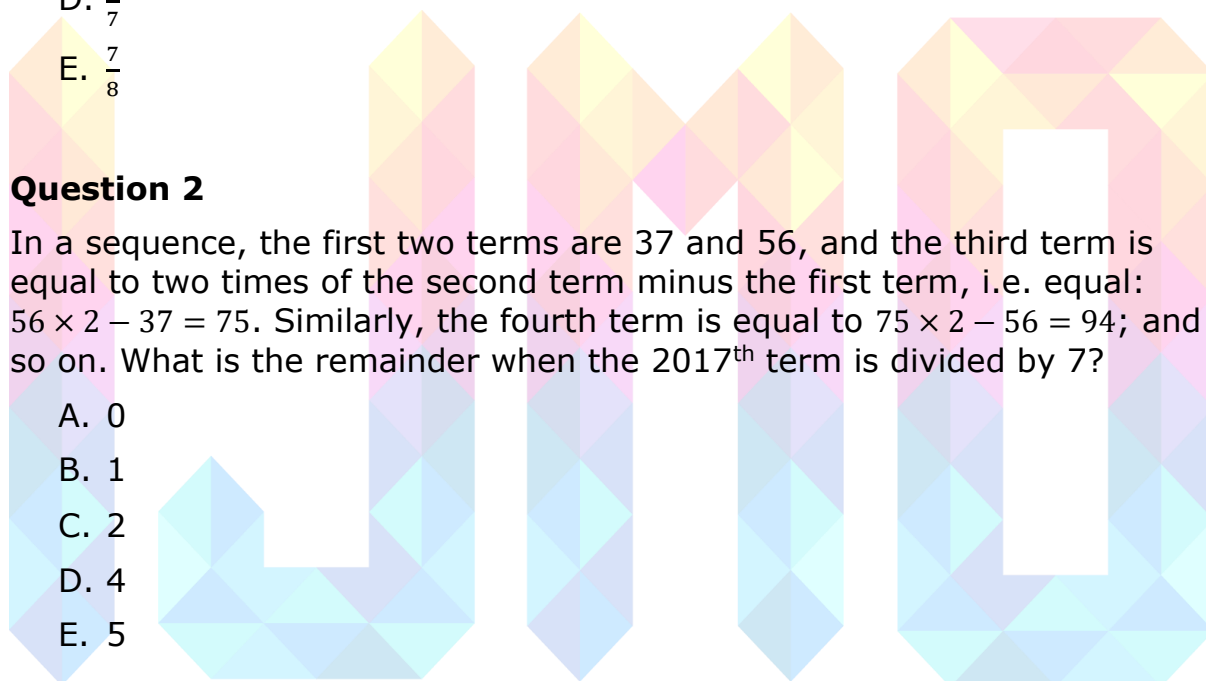
In a sequence, the first two terms are 37 and 56, and the third term is equal to two times of the second term minus the first term, i.e. equal:  $56 \times 2 - 37 = 75$ . Similarly, the fourth term is equal to  $75 \times 2 - 56 = 94$ ; and so on. What is the remainder when the 2017<sup>th</sup> term is divided by 7?

- A. 0
- B. 1
- C. 2
- D. 4
- E. 5

**Question 3**

Six-digit number 47A94B is divisible by 72. Find the value of  $A - B$ .

- A. 1
- B. 2
- C. 3
- D. 4
- E. 0



**Question 4**

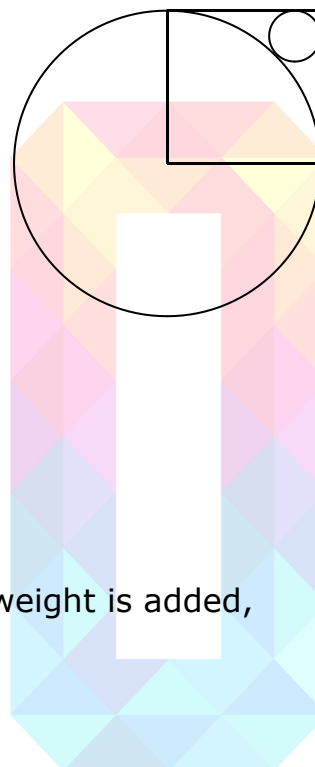
There are 37 numbers on a roulette wheel: 0 and the whole numbers from 1 to 36. What is the chance of getting a prime number?

- A. 10 out of 37
- B. 11 out of 37
- C. 12 out of 37
- D. 13 out of 37
- E. 14 out of 37

**Question 5**

The square in the figure has side length equal to 1. What is the radius of the small circle?

- A.  $\frac{1}{3}$
- B.  $\frac{1}{4}$
- C.  $\frac{1}{5}$
- D.  $\frac{1}{6}$
- E. None of the above



**Question 6**

The average of five weights is 13 grams. If a 7-gram weight is added, what is the average of the six weights?

- A. 11
- B. 12
- C. 13
- D. 14
- E. None of the above

**Question 7**

The 7-digit numbers  $74A52B1$  and  $326AB4C$  are multiples of 3. Which one of the following is the value of  $C$ ?

- A. 1
- B. 2
- C. 3
- D. 5
- E. 8

**Question 8**

A tournament had six players. Each player played every other player only once, with no ties. If Helen won 4 games, Ines won 3 games, Janet won 2 games, Kendra won 2 games and Lara won 2 games, how many games did Monica win?

- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

**Question 9**

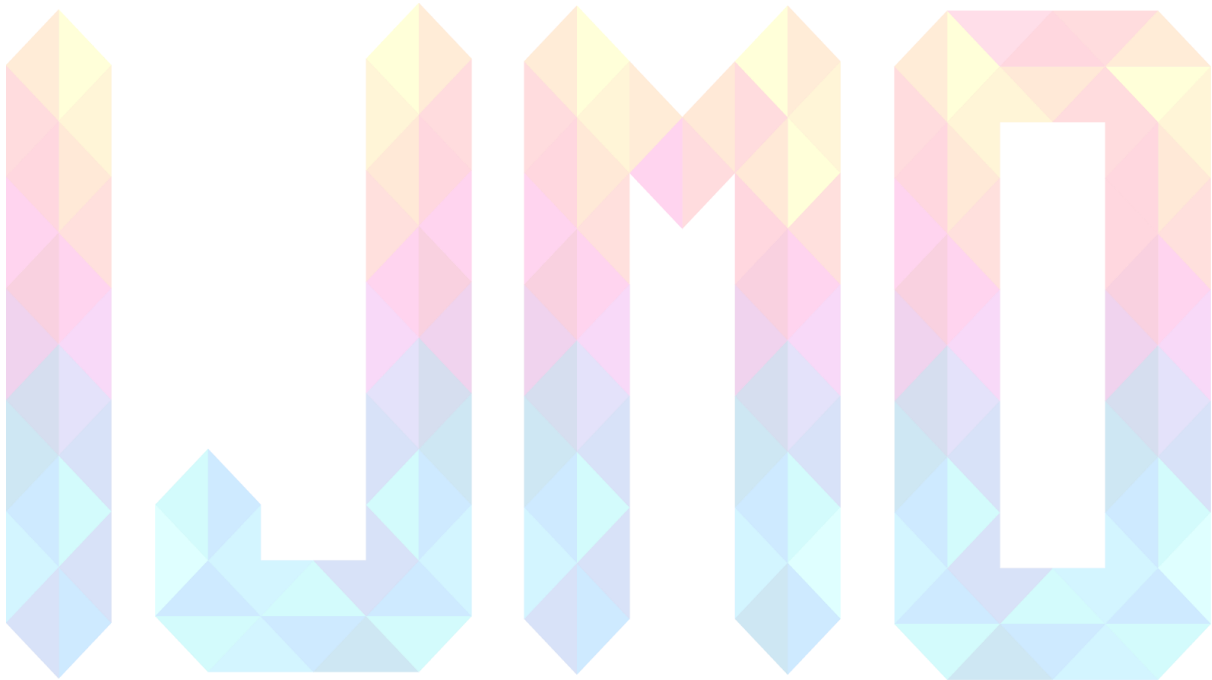
The following are the number of fishes that Tyler caught in nine outings last summer: 2, 0, 1, 3, 0, 3, 3, 1, 2. Which statement about the mean, median, and mode is true?

- A. median  $<$  mean  $<$  mode
- B. mean  $<$  mode  $<$  median
- C. mean  $<$  median  $<$  mode
- D. median  $<$  mode  $<$  mean
- E. mode  $<$  median  $<$  mean

**Question 10**

A "leap year" is a year which has 366 days including February 29 as an additional day. Any year that is divisible by 4 is a leap year, but a year that is divisible by 100 is a leap year only if it is also divisible by 400. How many leap years are there from 2000 to 2017?

- A. 3
- B. 4
- C. 5
- D. 6
- E. None of the above



**Section B** – 10 questions**Question 11**

Students from Mrs. Hein's class are standing in a circle. They are evenly spaced and consecutively labelled using whole numbers starting from 1. The student in place number 3 is standing directly across the student in place number 17. How many students are there in Ms. Hein's class?

- A. 28
- B. 29
- C. 30
- D. 31
- E. 32

**Question 12**

Jessica is an avid reader. She bought a copy of the best seller *Math is Beautiful*. On the first day, Jessica read  $\frac{1}{5}$  of the pages plus 12 more, and on the second day she read  $\frac{1}{4}$  of the remaining pages plus 15 pages. On the third day, she read  $\frac{1}{3}$  of the remaining pages plus 18 pages. She then realized that there were only 62 pages left to read, which she read the next day. How many pages are in this book?

- A. 120
- B. 180
- C. 240
- D. 300
- E. 360

**Question 13**

Reverse the digits of 1746 and we get 6471, the new number is larger than the original number by 4725. How many four-digit numbers satisfy such condition?

- A. 16
- B. 17
- C. 20
- D. 21
- E. None of the above

**Question 14**

Every day at school, Jo climbs a flight of 6 stairs. Jo can climb using 1, 2 or 3 steps or a combination of any of them. How many ways can Jo climb the flight of 6 stairs?

- A. 13
- B. 18
- C. 20
- D. 22
- E. 24

**Question 15**

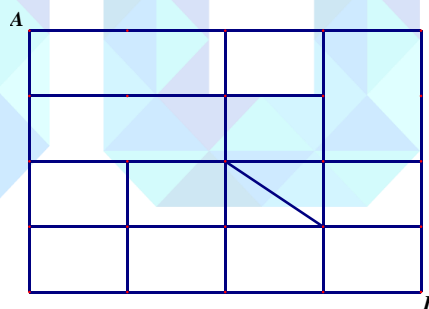
A two-digit number formed by any 2 adjacent digits of a 2017-digit number is divisible by 17 or 23. If the last digit of the 2017-digit number is 1, find the first digit.

- A. 2
- B. 3
- C. 4
- D. 6
- E. 9

**Question 16**

What is the number of shortest paths from A to B?

- A. 4
- B. 5
- C. 6
- D. 8
- E. None of the above





**Question 17**

If  $a_1 + a_2 = 1$ ,  $a_2 + a_3 = 2$ ,  $a_3 + a_4 = 3$ ,  $a_4 + a_5 = 4$ , ...  $a_{50} + a_{51} = 50$  and  $a_{51} + a_1 = 51$ , then what is the sum of  $a_1, a_2, a_3, \dots, a_{51}$ ?

- A. 663
- B. 1326
- C. 1076
- D. 538
- E. 665

**Question 18**

The solution set of  $\frac{x}{a} + \frac{1}{b} > 0$  is  $x < \frac{1}{3}$ , where  $a$  and  $b$  are constants.

Determine the solution set of  $bx - a > 0$ .

- A.  $x > \frac{1}{3}$
- B.  $x < -\frac{1}{3}$
- C.  $x > -\frac{1}{3}$
- D.  $x < \frac{1}{3}$
- E. None of the above

**Question 19**

A game consists of black and white pieces. The number of black pieces is 5 more than 3 times the white pieces. Seven white and 15 black pieces are removed each round. After several rounds, there are 3 white and 56 black pieces left. How many pieces were there in the beginning?

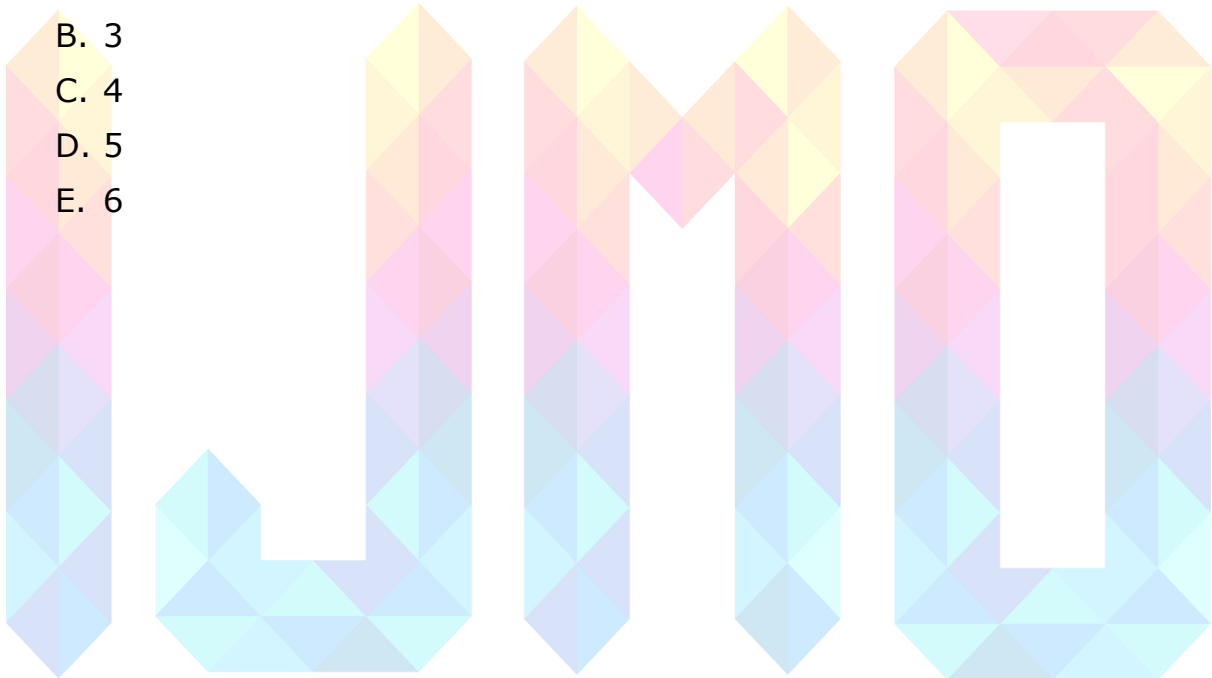
- A. 52
- B. 158
- C. 210
- D. 213
- E. 218

**Question 20**

The digits 1, 2, 3, 4, 5, and 6 are each placed in one of the boxes so that the multiplication below is correct. The digit represented by “?” is \_\_\_\_\_.

$$\begin{array}{r}
 \square \square \\
 \times \square \\
 \hline
 \square \square \square
 \end{array}$$

- A. 2
- B. 3
- C. 4
- D. 5
- E. 6



**Section C** – 10 questions**Question 21**

You are asked to move several boxes. You know nothing about the boxes except that each box weighs no more than 10 tons and their total weight is 100 tons. You can rent several trucks, each of which can carry no more than 30 tons. What is the minimum number of trucks you can rent to ensure that all the boxes can be carried at once?

**Question 22**

On the island of Nevermind, some people are liars who always lie. The remaining habitants of the island are truthlovers who tell only the truth. Three habitants of the island, A, B, and C met this morning.

A said: "All of us are liars".

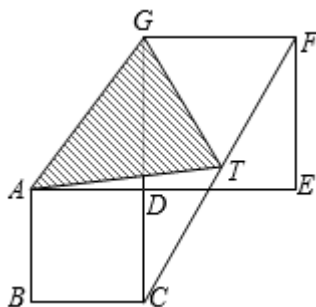
B said: "Only one of us is a truthlover".

Who is the truthlover?

(Write 0001 if the answer is A; or 0002 if the answer is B; or 0003 if the answer is C; or 0004 if none of them)

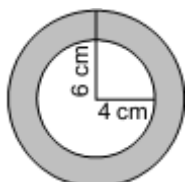
**Question 23**

Given two squares ABCD and DEFG with sides 6 cm and 8 cm, respectively. Let T be the midpoint of line segment CF. Find the area of triangle ATG.



**Question 24**

Ahmad has two pendants made up of the same material. They are equally thick and weigh the same. One of them has a shape of a grey "annulus" formed by two circles with radius 6 cm and 4 cm (see the diagram). The second has the shape of a solid circle. What is the square of the radius (i.e. radius  $\times$  radius) of the second pendant?



**Question 25**

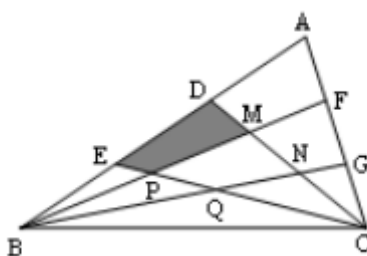
Let the operation  $*$  be defined by  $a * b = ab - a - b + 2$ . If  $7 * b = 13$ , what is the value of  $b$ ?

**Question 26**

The brothers Tom and Jason gave truthful answers to the question about the number of members their chess club has. Tom said: "All the members of our club, except five girls, are boys." Jason said: "Every six members always includes at least four girls." What is the least number of members in their chess club?

**Question 27**

As shown in the figure, the area of  $\triangle ABC$  is 42. Points D and E divide the side AB into 3 equal parts, while F and G do the same thing to AC. CD intersects BF and BG at M and N, respectively. CE intersects BF and BG at P and Q, respectively. What is the area of the quadrilateral EPMD?



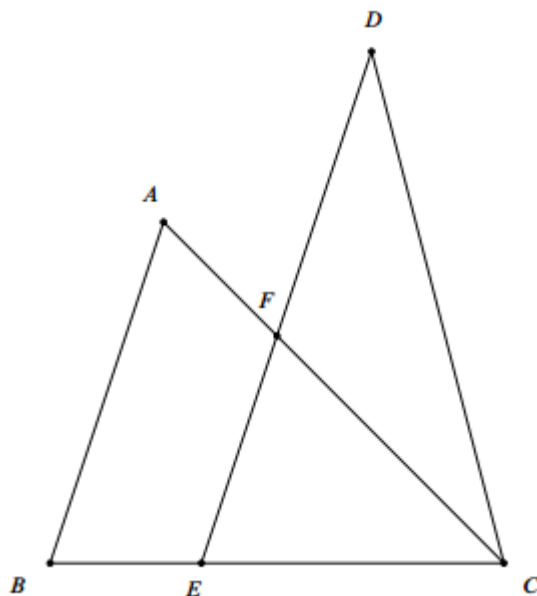
**Question 28**

Solve the following equation

$$x + \frac{x}{1+2} + \frac{x}{1+2+3} + \dots + \frac{x}{1+2+3+\dots+2017} = 2017.$$

**Question 29**

In the picture below, triangles  $ABC$  and  $CDE$  have the same areas. Let  $F$  be the point of intersection of  $AC$  and  $DE$ . It is known that  $AB$  is parallel to  $DE$ .  $AB = 9$  cm and  $DF = 7.5$  cm. Find the length of  $EF$  in cm.

**Question 30**

The sum of several distinct positive integers is equal to 30. What is the largest possible product of these numbers?

**END OF PAPER**

1	B
2	C
3	D
4	B
5	E
6	B
7	A
8	C
9	C
10	C
11	A
12	C
13	E
14	E
15	A
16	C
17	A
18	C
19	D
20	B
21	0004
22	0002
23	0037
24	0020
25	0003
26	0007
27	0005
28	1009
29	0006
30	7560

