CLASA a IV-a

Here are some suggestions to help you do your best:
- Read carefully each question and think about the answer before choosing your response.

RULES
- Part I has four multiple choice exercises.
- Part II must be solved into English.
- Part III must be translated into English, and then solved in English as well.

PART I.
1. Two 3x3 transparent sheets are darkened in some squares, as shown. They are both slid on top of the board shown in the middle.

Pictures behind the darkened squares cannot be seen. Only one of the pictures can still be seen, which one is it?

A  B  C  D  E

2. \(\bullet + \bullet + \bullet + \bullet + \square = \square + \square + \square\)

Imagine that the circles represent the same number and the same is true for the squares. Which one is true?

A  \(\bullet = \square\)  B  \(\bullet + \bullet + \bullet = \square\)  C  \(\square + \square + \square = \bullet\)

D  \(\square + \square = \bullet\)  E  \(\bullet + \bullet = \square\)

3. There is a tournament at the pool. First 13 children signed up and then another 19 signed up. Six teams with an equal number of players are needed for the tournament. At least how many more children need to sign up so that six teams can be formed?

A  1  B  2  C  3  D  4  E  5
4. Handsome Joe wants to cook 5 dishes on a stove with only 2 burners. The times needed to cook the 5 dishes are 40 min, 15 min, 35 min, 10 min and 45 min. What is the shortest time in which he can do it? (Once he starts cooking a dish, he may remove it from the stove only when it is cooked.)

A 60 min  B 70 min  C 75 min  D 80 min  E 85 min

PART II.
In a farm, there are lambs, ducks and one cat. Knowing that, there are 52 heads and 164 legs, find how many lambs and how many ducks are in the farm? (GM12/2017)

PART III.
Elevii prezenți la concursul de matematică au fost repartizați în mod egal în 9 sâli, astfel încât în fiecare sală numărul elevilor să fie mai mare decât 12 și mai mic decât 19. Dacă numărul fetelor este de patru ori mai mic decât numărul băieților, să se afle numărul concurenților.
CLASA a V-a

Here are some suggestions to help you do your best:

- Read carefully each question and think about the answer before choosing your response.

RULES

- Part I has four multiple choice exercises.
- Part II must be solved into English
- Part III must be translated into English, and then solved in English as well.

PART I.

1. Leo starts training at five in the afternoon. The walk from his house to the bus stop takes 5 minutes. The bus journey takes 15 minutes. It takes Leo 5 minutes to walk from the bus stop to the field. The bus arrives to his stop every 10 minutes from six in the morning at what time at the latest does Leo have to leave his house to arrive at the field exactly on time?

![Clocks](image)

A  B  C  D  E

2. A fly has 6 legs, a spider has 8 legs. Together, 3 flies and 2 spiders have as many legs as 9 chickens and several cats. How many cats are there?

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>2 cats</td>
<td>3 cats</td>
<td>4 cats</td>
<td>5 cats</td>
<td>6 cats</td>
</tr>
</tbody>
</table>

3. Adrian folded a piece of paper, used a hole-puncher and punched exactly one hole in the folded paper. Then, he unfolded the piece of paper, which looked as shown below?

![Paper](image)
Which of the following pictures shows the lines along which Bob folded the piece of paper?

A  
B  
C  
D  
E  

4. A special dice has a number on each of its six faces. The sum of the numbers on opposite faces are all equal. Five of the numbers are 5, 6, 9, 11 and 14. What number is on the sixth face?  
A  4  
B  7  
C  8  
D  13  
E  15

PART II.  
Be natural numbers not null $a_1, a_2, \ldots, a_{2019}$.  
a) Prove that $(a_1 + a_2)(a_2 + a_3) \cdots (a_{2019} + a_1)$ is an even number.  
b) Find the remainder of the number $n = 4(a_1 + a_2)(a_2 + a_3) \cdots (a_{2109} + a_1) - 1$ divided by 5.

PART III.  
Fiecare element din şirul numerelor naturale nenule, mai mici decât 21, se colorează cu câte o culoare, respectând următoarea regulă: dacă un număr are o anumită culoare, atunci orice divizor propriu al său are aceeași culoare. Stabiliţi numărul maxim de culori care pot fi utilizate. (GM12/2017)

Notă: divizor propriu al unui număr natural $n$ este orice divizor al numărului diferit de 1 și de $n$. 
CLASA a VI-a

Here are some suggestions to help you do your best:

- Read carefully each question and think about the answer before choosing your response.

RULES

- Part I has four multiple choice exercises.
- Part II must be solved into English.
- Part III must be translated into English, and then solved in English as well.

PART I.

1. There are 32 students in your class. Part of the students took one pencil each from the box with pencils on the teacher’s desk. Then a third of the remaining students took 3 pencils each, and there were no more pencils left in the box. How many pencils were there in the box at first?
   A) 16  B) 24  C) 32  D) 43  E) 64

2. Sophia wrote all the numbers from 1 to 20 in a row and obtained the 31-digit number
   1234567891011121314151617181920
   Then he deleted 24 of the 31 digits, so that the remaining number was as large as possible. Which number was it?
   A) 9671819  B) 9567892  C) 9781920  D) 9912345  E) 9818192

3. Mike wants to colour the squares of the rectangle so that 1/3 of all squares are blue and half of all squares are yellow. The rest of the squares are to be coloured red. How many squares will he colour red?

   A) 1  B) 2  C) 3  D) 4  E) 5
4. Alfie the Ant started at the left end of a board and crawled $\frac{2}{3}$ of its length. Ben the Beetle started at the right end of the same board and crawled $\frac{3}{4}$ of its length. What fraction of the length of the board are Alfie and Ben now apart?

A 3/8  
B 1/12  
C 5/7  
D 1/2  
E 5/12

PART II.
Find the natural numbers $a$, $b$ that satisfied the equation:

$$a \cdot b + 63 = 20 \cdot \text{lcm}(a, b) + 12 \cdot \text{gcd}(a, b)$$

Note: $\text{gcd}(a, b)$ denotes the greatest common divisor for $a$ and $b$

$\text{lcm}(a, b)$ denotes the least common multiple for $a$ and $b$

PART III.
Se considera un segment $[AB]$ cu lungimea de 120 cm și punctele $M_1$, $M_2$, ..., $M_n$, $n \in \mathbb{N}^*$, aparținând segmentului $[AB]$ astfel încât $AM_i = k_i$, unde $k_i$ este un număr natural nenul și $i \in \{1, 2, ..., n\}$. Colorăm cu roșu punctele $M_i$ pentru care lungimile segmentelor $AM_i$ și $M_iB$ se exprimă prin numere prime. Restul punctelor considerate se colorează cu albastru. Care este valoarea maxima a lui $n$ și câte puncte sunt colorate cu albastru în acest caz?
CLASA a VII-a

Here are some suggestions to help you do your best:

- Read carefully each question and think about the answer before choosing your response.

RULES

- Part I has four multiple choice exercises.
- Part II must be solved into English.
- Part III must be translated into English, and then solved in English as well.

PART I.

1. In the diagram it is represented a dashed line and a black path from seven equilateral triangles. The length of the dashed line is 20 cm. What is the length of the black path, in cm?

   A 25       B 30       C 35       D 40       E 45

2. Andy wants to cut a long wooden stick into nine pieces of the same length. He marked the position of the cuts; however, he did not have the time to cut the stick. Bianca wanted to cut the same stick into only eight pieces of the same length and, without seeing the marks made by Andy, marked the position where she had to cut. However, she also postponed cutting the stick for later. Meanwhile Chris took the stick and cut it along all marks he saw. How many pieces did Chris obtain?

   A 15       B 16       C 17       D 18       E 19
3. The measures of the angles in a triangle, in degrees, are three different integers. What is the minimum possible sum of its smallest and largest angles?

- A $61^0$
- B $90^0$
- C $91^0$
- D $120^0$
- E $121^0$

4. The product of three consecutive number is $2^3 \cdot 3^3 \cdot 7 \cdot 13$. What is the sum of these three numbers?

- A 75
- B 78
- C 81
- D 85
- E 86

PART II.
Let $ABCD$ be a trapezoid with $AB \parallel CD$. The point $M$ is the middle point of diagonal $AC$. We draw the line $MN \parallel BD$, $N \in AB$. If $CN \perp AB$, prove that the distance from point $A$ to line $BC$ is equal with the distance from point $B$ to line $AD$? (GM10/2017)

PART III.
La o petrecere, Livia îi cunoaște pe toți cei prezenți, pe unii după nume, pe alții după chip. Ea cunoaște după nume și după chip 40% dintre cei prezenți (în afară de ea), după chip 75% dintre cei prezenți (în afară de ea), iar după nume cunoaște 26 de persoane (în afară de ea). Câte persoane au fost la petrecere?
CLASA a VIII-a

Here are some suggestions to help you do your best:

- Read carefully each question and think about the answer before choosing your response.

RULES

- Part I has four multiple choice exercises.
- Part II must be solved into English
- Part III must be translated into English, and then solved in English as well.

PART I.

1. Two segments, each 1 cm long, are marked on opposite sides of a square of side 8 cm. The ends of the segments are joined as shown in diagram. What is the shaded area, in cm²?

   A 2  B 4  C 6.4  D 8  E 10

2. What is the value of \( \left( \sqrt{2} \right)^2 \)?

   A 2  B \( \sqrt{2} \)  C \( 2\sqrt{2} \)  D 8  E 4

3. The positive number \( p \) is less than 1, and the number \( q \) is greater than 1. Which of the following numbers is the largest?

   A \( p \cdot q \)  B \( p + q \)  C \( \frac{p}{q} \)  D \( p \)  E \( q \)

4. Two right regular rectangular prisms \( A \) and \( B \) have the same volume. The side of the base of \( B \) is 10% larger than that of \( A \). By what percentage is the altitude of \( A \) larger than that of \( B \)?

   A 5%  B 10%  C 11%  D 20%  E 21%
PART II.
Last year Livia took 7 math tests and received 7 different scores, each an integer between 91 and 100, inclusive. After each test she noticed that the average of her tests scores was also an integer. Her score on the seventh test was 95. Which was the score on the sixth test?

PART III.
Fie $ABCD'$ a cub cu latura $AB = 4 \text{ cm}$ și $B'C' \cap BC = \{O'\}$.

a) Dacă $AO' \cap D'C' = \{P\}$, calcuzați distanța de la punctul $P$ la drapta $AC$.

b) Dacă $AB' \cap A'B = \{O\}$ și punctul $M \in (BB')$ atunci

\[
\sin(\angle BOM) = \frac{2\sqrt{5}}{5}, \text{ găsiți lungimea segmentului } BM \text{. (GM11/2017)}
\]
CLASA a IV-a

RĂSPUNSURI PARTEA I
Grila

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>E</td>
<td>D</td>
<td>C</td>
<td></td>
</tr>
</tbody>
</table>

RĂSPUNSURI PARTEA A II-A

α - elveți (students)
fețe - ț. (girls)
boarță = 4 x ț. (guys)
9. \( \alpha = f + 4x\) ț.
9. \( \alpha = 5\) ț.

\[ 12 < \alpha < 19 \]
\[ \alpha = 13, 14, 15, 16, 17, 18. \]
9. \( \alpha = 15 \)
9. \( 15 = 5\) ț.
135 = 5 ț.
135 - elveți au participat. (students participated)

RĂSPUNSURI PARTEA A III-A

52 - capete (heads)
164 - picioare (legs)
\( h_i + \text{hat} + 1 \text{piece} = 52 \)
\( h_i + \text{hat} = 51 \text{capete (heads)} \)
164 - 4 = 160 picioare (legs)
\( \alpha - \text{hi (lamb)} \)
51 - \( \alpha - \text{hat (ducks)} \)
\( \alpha \times 4 + (51 - \alpha) \times 2 = 160 \)
\( \alpha + 102 - 2 \alpha = 160 \)
4 \( \alpha - 2 \alpha = 160 - 102 \)
2 \( \alpha = 58 \)
\( \alpha = 29 \text{ or (lamb)} \)
51 - 29 = 22 hati (ducks)
CLASA a V-a

RĂSPUNSURI PARTEA I
Grila

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
</tbody>
</table>

RĂSPUNSURI PARTEA A II-A

A) dacă unul dintre nr. $a_1, a_2, a_3+3, \ldots, a_{2019}+1$ este par, atunci produsul este par.
   Presăroare, nr. $a_1, a_2, a_3, \ldots, a_{2019}$, numărul par.
   $a_1+a_2 = 2k_1+1$
   $a_2+a_3 = 2k_2+1$
   $a_{2019} + 1 = 2(k_{2019} + 1)$

B) nu există par = nu există impar – imposibil
   Cel puțin unul dintre nr. $a_1, a_2, a_3, \ldots, a_{2019}$, numărul par.
   $4^{(a_1+a_2)} \cdot \ldots \cdot (a_{2019}+1) = 4^{(2k+1)} = 5$
   $R = 0$

RĂSPUNSURI PARTEA A III-A

A) suma lor poate fi
   6 are culori $C_1 = 3$ are culori $C_1$
   $9, 15$ au același culoare
   20 are culori $C_1 = 5$ are culori $C_1$
   14 are culori $C_1 = 5$ are culori $C_1$

Nt. maxim de culori:

1 → $C_2$
4 → $C_3$
13 → $C_4$
17 → $C_5$
19 → $C_6$

De 50 de culori folosim 6 culori.
CLASA a VI-a

RĂSPUNSURI PARTEA I
Grila

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C</td>
<td>C</td>
<td>E</td>
</tr>
</tbody>
</table>

RĂSPUNSURI PARTEA A II-A

\[
\begin{array}{l}
\text{Part II} \quad a \cdot b = m \cdot d \\
\text{1 m} \\
\end{array}
\]

\[
\begin{array}{l}
m \cdot d + 63 = 20 \cdot m + 12 - d \\
\Rightarrow \ (m-12)(d-20) = 177 = 3 \cdot 59 \quad (5p) \\
\Rightarrow \ d=21, \ m=189 \quad (5p) \\
\quad d=23, \ m=79 \quad \text{nu convine} \quad (3p) \\
\end{array}
\]

\[
\begin{array}{l}
d=21, \ m=189 \Rightarrow (21; 189), (189; 21) \quad (5p)
\end{array}
\]

RĂSPUNSURI PARTEA A III-A

\[
\begin{array}{l}
\text{Part III} \quad \text{valoarea maximă a lui } n \text{ se}
\end{array}
\]

\[
\begin{array}{l}
\text{obține pentru } AM_i = 1 \\
\Rightarrow AB = 120 \text{ cm} \quad \Rightarrow M = 119 \quad (5p)
\end{array}
\]

Căutăm puncte pe 2, de numere prime
cu \( p+q = 120 \Rightarrow (7, 113); (11, 109) \\
(13, 107); (17, 103); (19, 101); (23, 97); (31, 89) \\
(37, 83); (41, 79); (47, 73), (53, 67), (59, 61) \\
\Rightarrow 24 \text{ de puncte reau} \quad (10p) \\
\Rightarrow 119 - 24 = 95 \text{ puncte albe} \quad (5p)
\]
RĂSPUNSURI PARTEA I

Grila

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>B</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>

RĂSPUNSURI PARTEA A II-A

\[ \text{Fie } CE \parallel BD \parallel MN, \ E \in AB \]
\[ \triangle ACE : [MN] = \text{linie mediana } \Rightarrow N = \text{m} \angle CAE \]
\[ \triangle CAE \text{ isoscel } \Rightarrow [CE] = [CA] \]
\[ \triangle DBE \parallel CE \Rightarrow \text{paralelogram } \Rightarrow [DB] = [CE] \]
\[ \Rightarrow \text{trapez isoscel } \Rightarrow AD = BC \]
\[ \Rightarrow \text{V. } ABD = A \text{ ACB } \Rightarrow d(B; AD) \cdot AD = \frac{d(A; BC) \cdot BC}{2} \]
\[ \Rightarrow d(B; AD) = d(A; BC) \]

RĂSPUNSURI PARTEA A III-A

\[ \frac{95}{100} \cdot x + 26 - \frac{40}{100} \cdot x = x \]
\[ \Rightarrow x = 40 \]
\[ \Rightarrow 41 \text{ persoane la petrecere} \]
CLASA a VIII-a

RĂSPUNSURI PARTEA I
Grila

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>B</td>
<td>E</td>
</tr>
</tbody>
</table>

RĂSPUNSURI PARTEA A II-A

\[ m_1, m_2, m_3, m_4, m_5, m_6 \in \{ 91, 92, \ldots, 100 \} \]
\[ m_1 + m_2 + \ldots + m_6 = 5 \]
\[ 91.6 \leq 5 \leq 100.6 \quad (\Rightarrow 546 \leq 5 \leq 600) \]
\[ (S + 95) : 7 \Rightarrow S + 4 : 7 \Rightarrow S + 4 = 7k - 6 \]
\[ S : 6 \]
\[ S = 6p + 1.7 \]
\[ \Rightarrow 6S + 24 = 42k \]
\[ + S = 42p \]
\[ \Rightarrow S - 24 = 42 \]
\[ S = 42 \cdot p + 24 \]

\[ 546 \leq 42c + 24 \leq 600 \quad 1 - 2c \]
\[ 522 \leq 42c \leq 576 \]
\[ 12 < c < 14 \]
\[ c = 13 \]
\[ \Rightarrow S = 42 \cdot 13 + 24 = 570 \]

\[ m_1 + m_2 + m_3 + m_4 + m_5 + m_6 : 5 \]
\[ S = 570 \]
\[ \Rightarrow m_6 : 50 \]
\[ m_6 = 95 \]
\[ \Rightarrow m_6 = 100 \]

RĂSPUNSURI PARTEA A III-A

a) \( \text{Fie } M \text{ nomenclatul lui } O \text{ fata de } C \)
\[ \Rightarrow PN \perp (ABC) \]
\[ \Rightarrow PE \perp AC \Rightarrow d(P; AC) = PE \]
\[ NE = 2V_2 \quad \Rightarrow PE = 2V_6 \]

b) \( \text{Fie } BM = x \)
\[ \text{sin B}M = \frac{MM'}{BM} = \frac{OM'}{OM} = \frac{x\sqrt{2}}{4} \]
\[ = \frac{x\sqrt{2}}{4} + \frac{x\sqrt{2}}{2} = 2\sqrt{2} \Rightarrow x = \frac{2}{\sqrt{3}} \]
Suggested answers grade 4
PART III.
The students who take part in the mathematical contest were equally distributed in nine classrooms, so that the number of students in each classroom is greater than 12 and less than 19. If the number of girls is four times less than the number of boys, find out how many students take part in the contest.

Suggested answers grade 5
PART III.
Each element in the string of natural numbers, that is less than 21, is painted in a different colour according to the following rule: if a number is painted in one colour, then any of its proper divisors/factors is painted in the same colour. Find out the maximum number of colours that can be used (GM12/2017)
Note: a proper divisor/factor of a natural number \( n \) is any divisor of that number which is not equal to 1 and \( n \).

Suggested answers grade 6
PART III.
Let’s consider \([AB]\) a segment with the length of 120 cm and \(M_1, M_2, \ldots, M_n\), \(n \in \mathbb{N}^*\), points on \([AB]\) so that \(AM_i=k_i\), and \(k_i\) is a natural non-zero number and \(i \in \{1, 2, \ldots, n\}\). We colour in red the \(M_i\) points for which the lengths of segments \(AM_i\) and \(M_iB\) are prime numbers. The rest of the points are coloured in blue. What is \(n\)’s maximum value and how many points are coloured in blue in this case?

Suggested answers grade 7
Part iii.
At a party, Livia knows everybody, some by their name, others by their appearance. She knows 40% of the guests by both name and appearance (except for herself), 75% by their appearance and 26 people (except for herself) by their names. How many people were there at the party?

Suggested answers grade 8
PART III.
Let \(ABCD\) be a cube with the side \(AB=4\) cm and \(BC'\cap B'C=\{O'\}\).
\(\)a) If \(AO'\cap D'C'=\{P\}\), calculate the distance from point \(P\) to side \(AC\).
\(\)b) If \(AB'\cap A'B=\{O\}\) and point \(M\in (BB')\) then
\[\sin(\angle BOM) = \frac{2\sqrt{5}}{5},\] find the length of \(BM\) segment. (GM11/2017)
CONCURSUL INTERDISCIPLINAR
 Mathematics-English Testing System
 16 martie 2018
 9:00 – 11:00