ÉRETTSÉGI VIZSGA • 2021. október 19.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2021. október 19. 8:00

I.

Időtartam: 57 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

EMBERI ERŐFORRÁSOK MINISZTÉRIUMA

Instructions to candidates

1. The time allowed for this examination paper is 57 minutes. When that time is up, you will have to stop working.

2. You may solve the problems in any order.

3. On solving the problems, you may use a calculator that cannot store and display textual information. You may also use any edition of the four-digit data tables. The use of any other electronic device or printed or written material is forbidden!

4. **Enter the final answers in the appropriate frames.** You are only required to detail your solutions where you are instructed by the problem to do so.

5. Write in pen. Diagrams may be drawn in pencil. The examiner is instructed not to mark anything written in pencil, other than diagrams. If you cancel any solution or part of a solution by crossing it over, it will not be assessed.

6. Only one solution to each problem will be assessed. In case of more than one attempt to solve a problem, indicate clearly which attempt you wish to be marked.

7. Please **do not write in the grey rectangles**.

1. There are two sets A and B and it is known that $A \cup B = \{1; 2; 3; 4; 5; 6; 7; 8; 9\}$, $A \setminus B = \{7; 8; 9\}$, and $B \setminus A = \{1; 2\}$. Give the set $A \cap B$ by listing its elements.

$A \cap B =$	2 points	

2. Dorka and six of her friends bought cinema tickets to adjacent seats in the same row. How many seating arrangements are possible for the seven girls to sit next to one another if Dorka sits on seat number 1?

	2 points	

3. Special lines of triangles are listed below. Which of these will always pass through one or the other midpoint of the sides of the triangle? (Give the corresponding letters.)

A: altitude   **B**: midsegment   **C**: median

D: angle bisector   **E**: perpendicular bisector

	3 points	

4. After reducing the price of a pullover by 15% it now costs 10 200 forints.
What was the price of the pullover before the reduction?

	2 points	

5. The function $f(x) = (x-3)^2 - 1$ is defined over the set of real numbers.
Tell where the function f has its minimum and give the minimum value, too.

The minimum is at:	1 point	
The minimum value is:	1 point	

6. Two stone blocks, one a cube, the other a cuboid, have the exact same volume. The edges
of the cuboid are 45 cm, 120 cm and 135 cm. How long (in cm) are the edges of the cube?

	2 points	

7. The table below shows the results of the mathematics mock exam of the senior year of a school. Arrange the data in a bar chart.

grade	frequency
1	5
2	15
3	50
4	25
5	10

frequency

grade
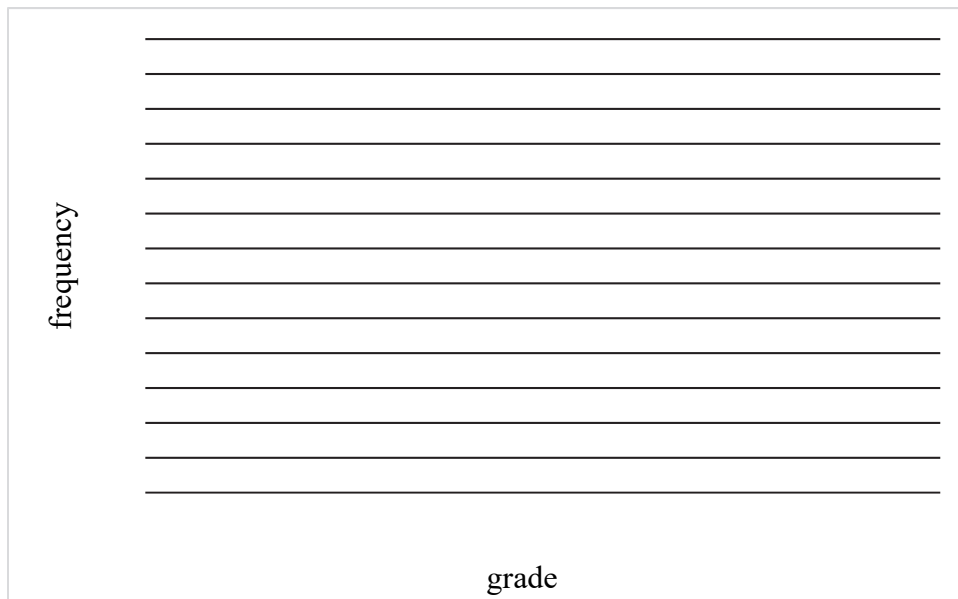
3 points	

8. Find the value of x given that $2^{x-1} = 16$.

$x =$	2 points	

9. A security guard works for four consecutive days then rests for two days. Then he works again for four days and rests for two, etc. Will the guard work or rest on the 100th day of the year, assuming he started working on January 1? Explain your answer.

	2 points	
	1 point	

10. The first term of a sequence is 5.
Starting with the second term, each new term of the sequence is 1 greater than (–2) times the previous term. Give the second and the third term of the sequence.

The second term:	1 point	
The third term:	1 point	

11. The centre of a circle is $K(3; 2)$ and the circle also passes through the point $P(-1; 5)$.
Give the length of the radius and also the equation of the circle.

The radius of the circle:	2 points	
The equation of the circle:	2 points	

12. Two fair gambling dice, one blue and one red, are rolled at the same time. Calculate the probability that the sum of the two numbers shown will be 11 or more. Explain your answer.

	2 points	
The probability:	1 point	

		score	
		maximum	awarded
Part I	Question 1	2	
	Question 2	2	
	Question 3	3	
	Question 4	2	
	Question 5	2	
	Question 6	2	
	Question 7	3	
	Question 8	2	
	Question 9	3	
	Question 10	2	
	Question 11	4	
	Question 12	3	
	TOTAL	**30**	

_____   _____
         date   examiner

	pontszáma **egész számra** kerekítve	
	elért	programba beírt
I. rész		

_____   _____
       dátum   dátum

_____   _____
     javító tanár   jegyző

Megjegyzések:
1. Ha a vizsgázó a II. írásbeli összetevő megoldását elkezdte, akkor ez a táblázat és az aláírási rész üresen marad!
2. Ha a vizsga az I. összetevő teljesítése közben megszakad, illetve nem folytatódik a II. összetevővel, akkor ez a táblázat és az aláírási rész kitöltendő!

ÉRETTSÉGI VIZSGA • 2021. október 19.

MATEMATIKA ANGOL NYELVEN

# KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2021. október 19. 8:00

II.

Időtartam: 169 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

EMBERI ERŐFORRÁSOK MINISZTÉRIUMA

Instructions to candidates

1. The time allowed for this examination paper is 169 minutes. When that time is up, you will have to stop working.

2. You may solve the problems in any order.

3. In part **B**, you are only required to solve two of the three problems. **When you have finished the examination, enter the number of the problem not selected in the square below**. *If it is not clear* for the examiner which problem you do not want to be assessed, the last problem in this examination paper will not be assessed.
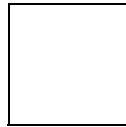
4. On solving the problems, you may use a calculator that cannot store and display textual information. You may also use any edition of the four-digit data tables. The use of any other electronic device or printed or written material is forbidden!

5. **Always write down the reasoning used to obtain the answers. A major part of the score will be awarded for this.**

6. **Make sure that calculations of intermediate results are also possible to follow.**

7. **The use of calculators** in the reasoning behind a particular solution **may be accepted without further mathematical explanation in case of the following operations**: addition, subtraction, multiplication, division, calculating powers and roots, $n!$, $\binom{n}{k}$, replacing the tables found in the 4-digit Data Booklet (sin, cos, tan, log, and their inverse functions), approximate values of the numbers π and e, finding the solutions of the standard quadratic equation. No further explanation is needed when the calculator is used to find the mean and the standard deviation, as long as the text of the question does not explicitly require the candidate to show detailed work. **In any other cases, results obtained through the use of a calculator are considered as unexplained and points for such results will not be awarded.**

8. On solving the problems, theorems studied and given a name in class (e.g. the Pythagorean Theorem or the height theorem) do not need to be stated precisely. It is enough to refer to them by name, *but their applicability needs to be briefly explained*.

9. Always state the final result (the answer to the question of the problem) in words, too!

10. Write in pen. Diagrams may be drawn in pencil. The examiner is instructed not to mark anything in pencil, other than diagrams. If you cancel any solution or part of a solution by crossing it over, it will not be assessed.

11. Only one solution to each problem will be assessed. In case of more than one attempt to solve a problem, **indicate clearly** which attempt you wish to be marked.

12. Please **do not write in the grey rectangles**.

A

13. When one takes a taxi in a certain town, the fare will be the sum of a fixed fee and a "per kilometre" fee. The fixed fee is independent of the total distance travelled, it is 700 Ft. The fee that is proportional to the distance travelled is 300 Ft per kilometre. (The taximeter turns continuously, rather than jumping at each full kilometre.)

    a) How much will the fare be for a 12.5 km ride?

    b) How many km-s did we travel if we paid 2275 forints?

    c) Use the coordinate system below to draw a graph of the fare against the distance travelled between 0 and 5 kilometres.
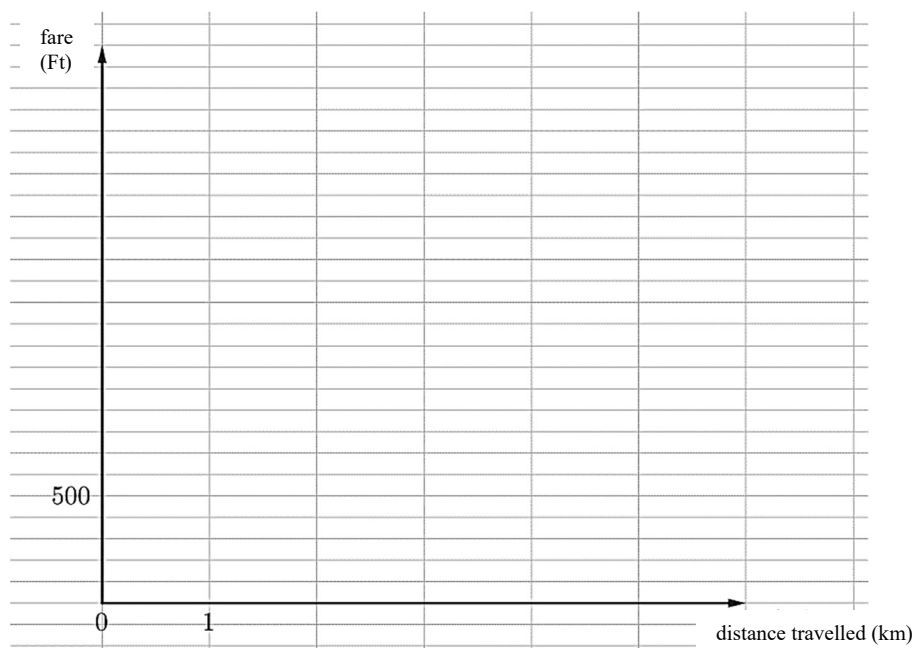
A similar fare system is used in another town, a fixed fee is added to a distance-based fee. Gergő took a taxi in this town on Monday and paid 2825 forints for a 6.5 km ride. On Tuesday, he paid 4190 forints for a 10.4 km ride.
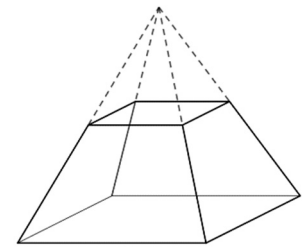
    d) Calculate the fixed fee and the fee for one kilometre in this town.

a)	2 points	
b)	2 points	
c)	3 points	
d)	5 points	
T.:	12 points	

14. The length of the base edges of a regular, square pyramid is 66 cm, the height of the pyramid is 56 cm.
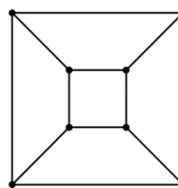
    a) Calculate the total surface area of the pyramid.

Cut the pyramid with a plane that is parallel to the base and bisects the height of the pyramid.

    b) Calculate the volume of the resulting truncated pyramid.

The vertices and edges of the truncated pyramid may also be drawn as a graph. Each of the 8 vertices of this graph will have a degree of 3.

    c) Would it be possible to draw a graph with 7 vertices such that the degree of each vertex is 3? (If your answer is **yes**, please draw such a graph. If your answer is **no**, please explain.)

a)	5 points	
b)	4 points	
c)	2 points	
T.:	11 points	

15. Dávid's English grades this semester are three 3-s and two 5-s. János has five English grades, too. The median of his grades is 1 greater than the median of Dávid's grades, while the mean of his grades is 1 less than the mean of Dávid's grades.

  a) Determine János' English grades. (All grades are integers.)

Eszter had 9 English grades in the first semester, the mean of which was exactly 3. She had 6 grades in the second semester, the mean of those grades was 4.5.

  b) What is the mean of Eszter's English grades for the whole year?

Select two different numbers randomly from the set {1; 2; 3; 4; 5}.

  c) What is the probability that the mean of the two numbers selected will be an integer?

a)	6 points	
b)	3 points	
c)	4 points	
T.:	13 points	

B

You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 2.

16. The three vertices of a triangle in a coordinate system are $A(5; 6)$, $B(4; 2)$ and $C(8; 2)$.

    a) Calculate the measure of the interior angle of the triangle at vertex A.

    b) Give the equation of the altitude through vertex B and calculate the coordinates of the orthocentre M of the triangle.

The triangle ABC is magnified to twice the size from point B, thus obtaining triangle $A'B'C'$.

    c) Give the coordinates of the vertices of triangle $A'B'C'$.

a)	6 points	
b)	7 points	
c)	4 points	
T.:	17 points	
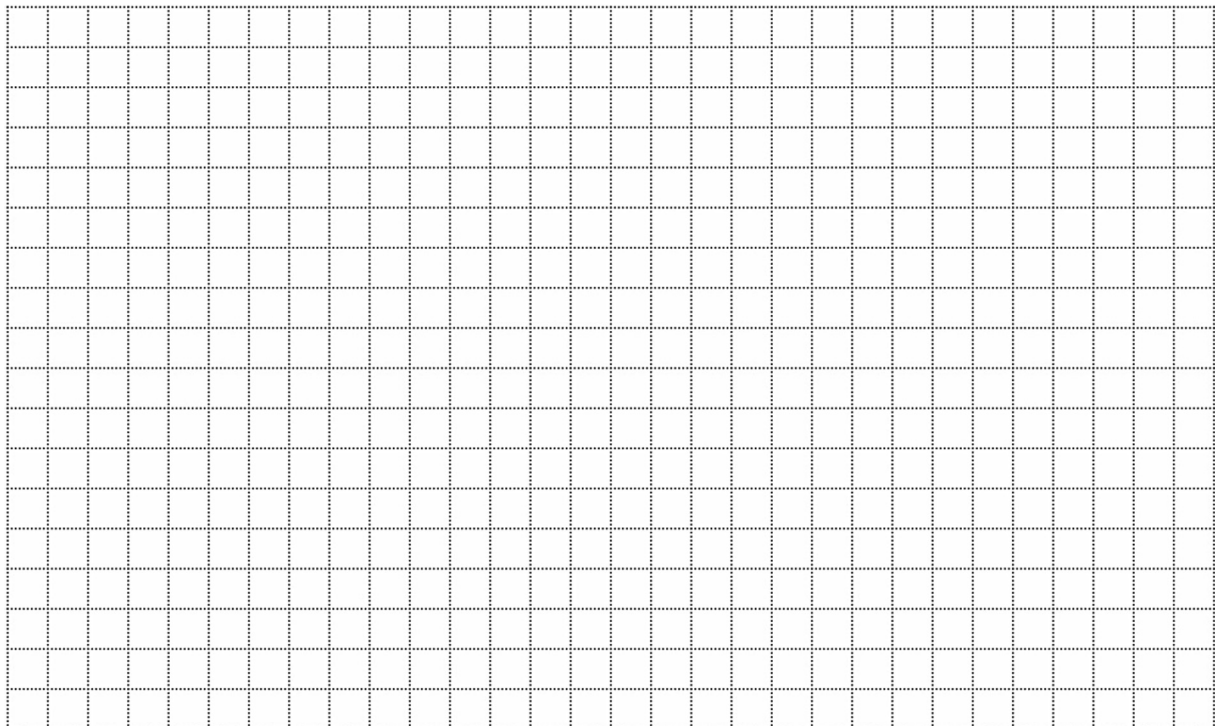
You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 2.

17.   **a)** The second term of an **arithmetic** sequence is 24, the fifth term is 81. By what percentage is the sum of the first 16 terms of the sequence greater than the 106th term?

     b) The second term of a **geometric** sequence is 24, the fifth term is 81. How many terms of this sequence are less than 10 000 000?

a)	8 points	
b)	9 points	
T.:	17 points	

You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 2.

18. There are twice as many students attending the high level mathematics course in a class than there are students attending high level physics. The total number of students attending at least one of these courses is 15, while 6 out of these 15 students attend both courses.

    a) How many students in this class are attending only the high level mathematics course but not physics?

During distance learning a total of 24 people (including the teacher) attended standard level mathematics classes. The online platform arranged the little congruent rectangles representing the participants in 4 rows and 6 columns, filling the screen completely. Stefi's computer screen has a horizontal to vertical length ratio of 16:9.
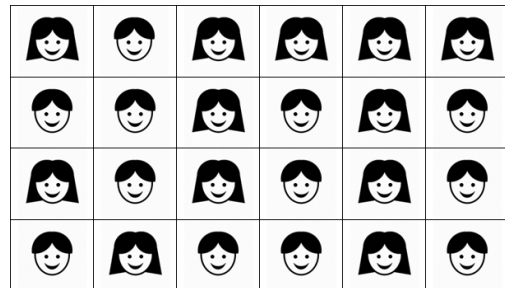
    b) Give the horizontal to vertical length ratio for one of the little rectangles as a ratio of two integers.

The platform arranges the 24 rectangles randomly on the screen.

    c) Calculate the probability that the rectangles representing Stefi and her friend Cili would both appear in the top row of the screen during the next class. (The 24 rectangles are always displayed in a 4 rows/6 columns arrangement.)

The rectangles for the 24 participants can be arranged in a total 24! different ways on the screen.

    d) Show that 24! is divisible by 10 000.

a)	4 points	
b)	5 points	
c)	5 points	
d)	3 points	
T.:	17 points	

	number of question	score		
		maximum	awarded	total
Part II A	13.	12		
	14.	11		
	15.	13		
Part II B		17		
		17		
		← question not selected		
	TOTAL	**70**		

	score	
	maximum	awarded
Part I	30	
Part II	70	
Total score on written examination	**100**	

_____   _____
            date   examiner

_____

	pontszáma **egész számra** kerekítve	
	elért	programba beírt
I. rész		
II. rész		

_____   _____
            dátum   dátum

_____   _____
        javító tanár   jegyző