

**ÉRETTSÉGI VIZSGA • 2024. október 15.**

# **MATEMATIKA ANGOL NYELVEN**

## **KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA**

**2024. október 15. 8:00**

**I.**

Időtartam: 57 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

**OKTATÁSI HIVATAL**

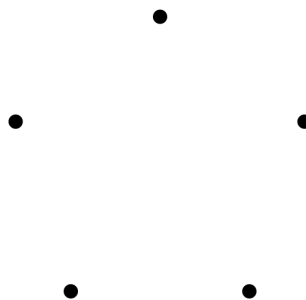
## Instructions to candidates

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 given:  $A = \{1; 2; 3; 4\}$  and  $B = \{1; 2; 4; 8\}$ .  
Give the sets  $A \cap B$ ,  $A \cup B$  and  $A \setminus B$  by listing their elements.!

$A \cap B =$	1 point	
$A \cup B =$	1 point	
$A \setminus B =$	1 point	

2. Draw a graph with five vertices where the valence (degree) of the vertices are 1, 2, 2, 3, 4.



2 points	
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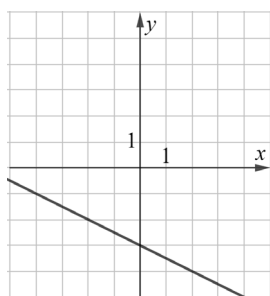
3. A bakery sells white bread and rye bread. Out of the first 30 customers on a particular morning 22 bought white bread, while 17 bought rye bread. How many customers bought both types of bread if all 30 of them bought at least one type?

	2 points	
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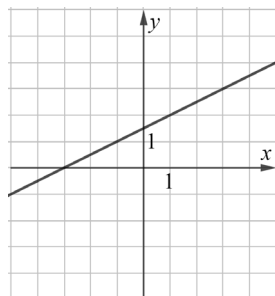
4. The first term of an arithmetic sequence is 6, the seventh term is 36.  
Give the fourth term of the sequence.

$a_4 =$	2 points	
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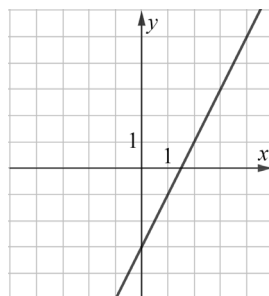
5. Select the diagram below that correctly represents the graph of the function  $f(x) = \frac{1}{2}x - 3$  defined over the set of real numbers.



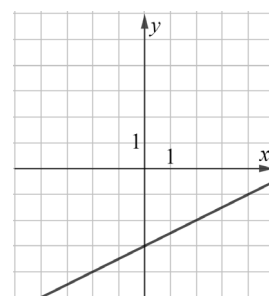
A



B



C



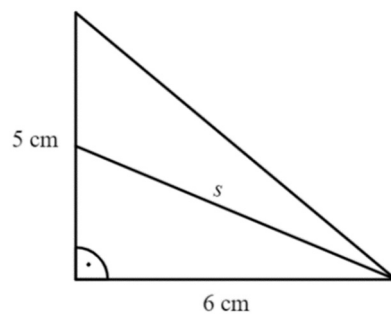
D

The correct diagram is:	2 points	
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6. How many diagonals does a convex octagon (8 sides) have?

	2 points	
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7. One leg of a right triangle is 5 cm, the other leg is 6 cm long. Calculate the length of the median that belongs to the 5 cm leg. Show your work.



The length of the median is:                      cm	2 points	
	1 point	

8. The digits 2, 3, 4, 5 are used to create four-digit numbers, such that each of them is only used once. How many of these four-digit numbers will be divisible by 4? Show your work.

	2 points	
	1 point	

9. Béla and András are playing a computer game. Béla has scored 4 times as many points as András. The two of them together have scored 6500 points. How many points has Béla scored?

Béla has scored                  points.	2 points	
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10. Anna's Biology grades are the following: two 5-s, four 4-s and two 3-s. Calculate the standard deviation of Anna's Biology grades.

The standard deviation:	2 points	
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- 11.** The eighth term of a geometric sequence is  $10^{20}$ , the ninth term is  $10^{23}$ .  
Give the common ratio and the first term of this sequence.

The common ratio:	1 point	
The first term:	2 points	

- 12.** Two fair gambling dice are thrown once. Calculate the probability that the sum of the numbers shown will be a square number. Show your work.

	3 points	
	1 point	

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

\_\_\_\_\_

date

\_\_\_\_\_

examiner

		pontszáma <b>egész számra</b> kerekítve	
		elért	programba beírt
I. rész			

\_\_\_\_\_

dátum

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dátum

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javító tanár

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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 • 2024. október 15.**

# **MATEMATIKA ANGOL NYELVEN**

## **KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA**

**2024. október 15. 8:00**

**II.**

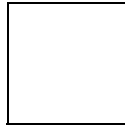
Időtartam: 169 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

**OKTATÁSI HIVATAL**

## 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  $\pi$  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. a)** Solve the following equation over the set of real numbers.

$$\frac{x+3}{4} + \frac{x+1}{5} = -\frac{x}{2}$$

Bacterial growth under laboratory conditions can be divided into several phases. In the first stage, the number of bacteria increases very quickly. Based on his experiments, a researcher concluded that the number of bacteria in the first few hours can be approximated with the formula  $b(p) = 6 \cdot 1,015^p$  where  $p$  is the number of minutes passed since the beginning of the experiment and  $b(p)$  is the number of bacteria **in thousands**  $p$  minutes after the beginning of the experiment.

- b)** Use the formula to calculate the number of bacteria 60 minutes after the beginning of the experiment.
- c)** During which **hour** after the beginning of the experiment will the number of bacteria reach 600 thousand based on the formula above?

<b>a)</b>	5 points	
<b>b)</b>	2 points	
<b>c)</b>	4 points	
<b>T:</b>	11 points	

Név: ..... osztály:.....

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**14.** The function  $f: \mathbf{R} \rightarrow \mathbf{R}$ ,  $f(x) = (x-3)^2 - 4$  is given.

**a)** What number does function  $f$  assign to  $x = 2.5$ ?

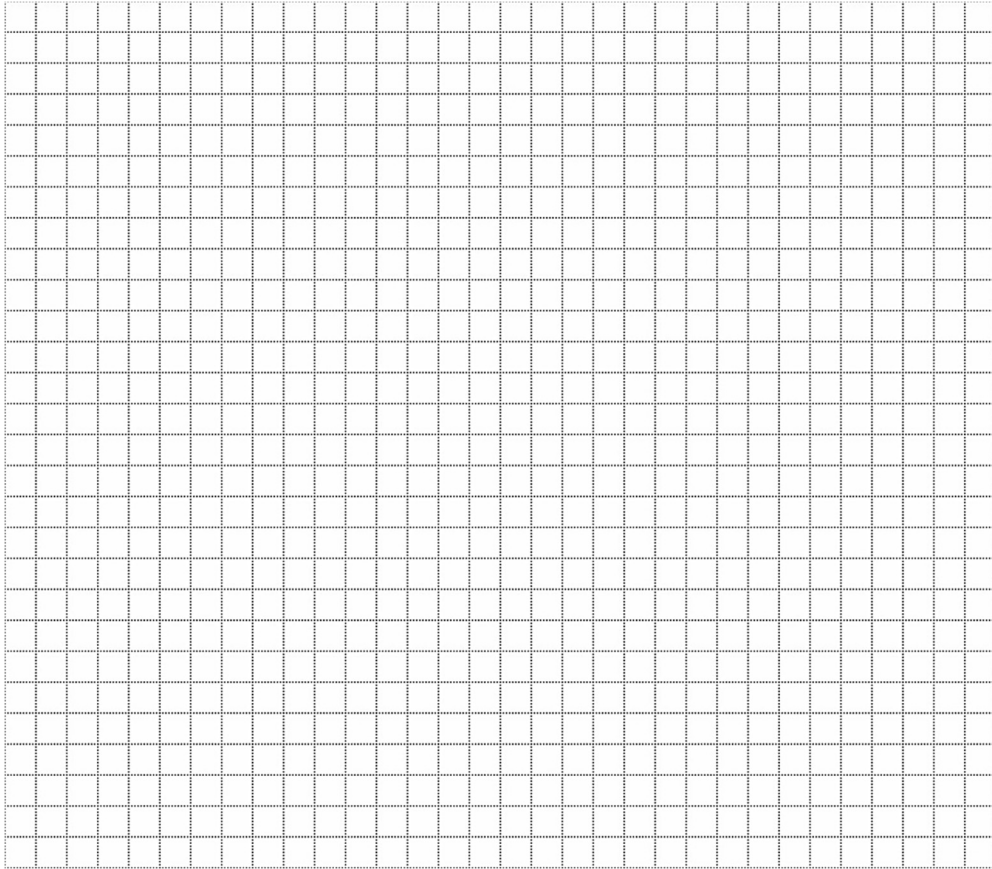
**b)** Determine the zeros of function  $f$ .

Points  $P(2; -3)$  and  $Q(6; 5)$  are two points on the graph of function  $f$ .

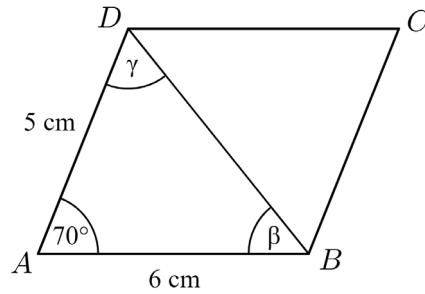
**c)** Calculate the distance between points  $P$  and  $Q$ .

**d)** Determine the equation of the line drawn across points  $P$  and  $Q$ .

<b>a)</b>	2 points	
<b>b)</b>	4 points	
<b>c)</b>	2 points	
<b>d)</b>	4 points	
<b>T:</b>	12 points	



- 15.** In parallelogram  $ABCD$ , side  $AB$  is 6 cm, side  $AD$  is 5 cm and the angle between these two sides is  $70^\circ$ .



- a) Calculate the area of parallelogram  $ABCD$ .
- b) Calculate the length of diagonal  $BD$  as well as the measure of the angles  $\beta$  and  $\gamma$ .

Consider the statement:

*"If a quadrilateral has a line symmetry, then that quadrilateral also has central symmetry."*

- c) Determine, whether the above statement is true or false. Explain your answer.
- d) State the converse of the above statement and determine whether the converse is true or false. Explain your answer.

a)	2 points	
b)	6 points	
c)	2 points	
d)	3 points	
<b>T:</b>	<b>13 points</b>	



Név: ..... osztály:.....

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**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.** Emese is baking cakes, for which she is buying 5 kg of sugar. Should she buy 4 kg of granulated sugar and 1 kg of brown sugar, she would pay 2600 forints. However, in case she bought 3 kg of granulated sugar and 2 kg of brown sugar, she would pay 3275 forints.

- a)** What does 1 kg of granulated sugar cost and what is the price of 1 kg of brown sugar?

Emese is using an English recipe book that gives mass in ounces. The recipe says to use 5 ounces of sugar. It is known that 1 kilogram is equivalent to about 35.3 ounces.

- b)** How many grams of sugar is Emese supposed to use?  
Round your answer to the nearest ten grams.

Emese has 72 jam linzers and 96 chocolate linzers. She is making identical packages out of these for the school cookie sale such that there is the same number of jam linzers in each package and also an identical number of chocolate linzers in each package using every one of her linzers.

- c)** What is the maximum number of packages Emese can make this way?

There are 10 jam linzers and 15 chocolate linzers in a cookie box. Five linzers are randomly selected (without replacement) from the box.

- d)** Calculate the probability that there will be exactly 2 jam linzers among the ones selected.

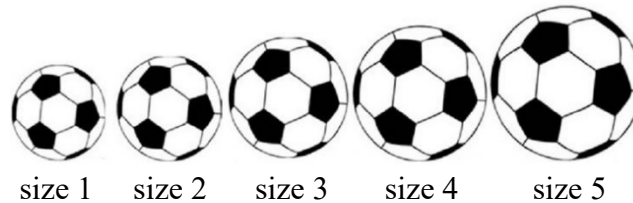
<b>a)</b>	6 points	
<b>b)</b>	3 points	
<b>c)</b>	4 points	
<b>d)</b>	4 points	
<b>T:</b>	17 points	

Név: ..... osztály:.....

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**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.** The actual size of the ball used in football matches depends on the age group of the team. The diameter of the size 3 ball, recommended for 8 year olds, is 18 cm. The diameter of the size 5 ball, recommended for players over 12, is 21.5 cm. (All balls are considered to be spheres.)



- a)** By what percentage is the volume of the size 5 ball greater than the volume of the size 3 ball?

There were 32 teams participating in the 2022 Qatar World Cup. These 32 teams were divided into 8 groups, 4 teams in each group. Within each group, every team played every other team of that group exactly once. A winning team earned 3 points, a tie earned 1 point for both participating teams, while a losing team got 0 points. The table on the right shows the points earned by the various teams in a group by the end of the group stage of the World Cup.

Rank	Score
1 <sup>st</sup>	7
2 <sup>nd</sup>	5
3 <sup>rd</sup>	4
4 <sup>th</sup>	0

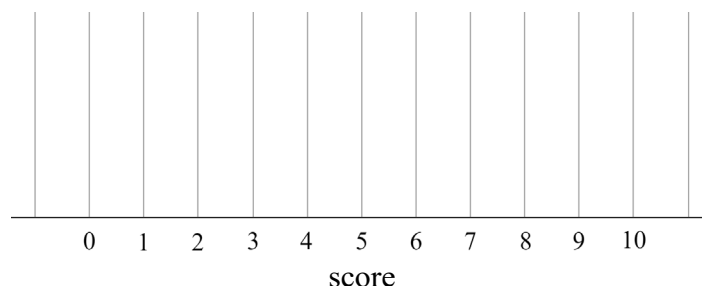
- b)** How many games ended in a tie in this group during the group stage?

The table below shows the frequency of the various scores for the 32 teams at the end of the group stage.

Score	0	1	2	3	4	5	6	7	8	9
Frequency	2	3	0	4	10	2	8	3	0	0

- c)** Determine the mean score of the 32 teams.
- d)** Fill in the table below using the data about the group stage scores and use it to draw a box-plot diagram.

minimum	lower quartile	median	upper quartile	maximum



Név: ..... osztály:.....

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<b>a)</b>	5 points	
<b>b)</b>	4 points	
<b>c)</b>	2 points	
<b>d)</b>	6 points	
<b>T:</b>	17 points	

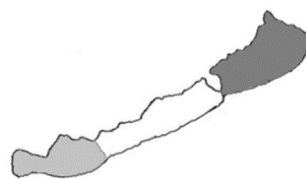
**You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 2.**

- 18.** Storm warning signals on lake Balaton are given by remote-controlled lights since 1988. There are three different levels of storm warning:

- As long as wind speeds do not exceed 45 km/h the system is in **standby** mode, no lights are shown.
- **Level 1** applies when wind speeds are between 45–60 km/h, signal lights are flashing 45 times per minute at equal intervals.
- **Level 2** applies when wind speeds exceed 60 km/h, signal lights are flashing 90 times per minute at equal intervals.

- a)** What is the level of storm warning when the lights flash 9 times in 12 seconds?

Since 2012, the Storm Warning System divides Balaton into three separate basins: western, middle and eastern. Different basins may show different storm warning levels (while all lights within the same basin must show the same level of warning), but levels in adjacent basins may only differ from each other by 1 level.



- b)** How many different arrangements of various storm warning signal levels may be applied across Balaton following the above rule? (An example: standby mode in the western basin, while level 1 in the middle and eastern basins. Two arrangements are considered different if the warning level is different in at least one of the basins.)

To estimate the volume of Badacsony hill, approximate it by a truncated cone that has a base circumference of 11 km, a top radius of 0.6 km, and a height of 330 metres.



- c)** Is it true that the (estimated) volume of the hill is greater than  $1.5 \text{ km}^3$ ?

The owner of a newly established Badacsony winery is making a business plan. In each consecutive year, starting from the second, he plans to make 5% more wine than in the preceding year. His plan is to make a total of 1000 hectolitres of wine in the first 10 years.

- d)** How many hectolitres of wine will he make in the tenth year, according to this plan?

<b>a)</b>	2 points	
<b>b)</b>	5 points	
<b>c)</b>	5 points	
<b>d)</b>	5 points	
<b>T:</b>	17 points	

Név: ..... osztály:.....

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

	score	
	maximum	awarded
Part I	30	
Part II	70	
<b>Total score on written examination</b>	<b>100</b>	

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date

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examiner

	pontszáma <b>egész számra</b> kerekítve	
	elért	programba beírt
I. rész		
II. rész		

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javító tanár

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jegyző