

ÉRETTSÉGI VIZSGA • 2019. május 7.

**MATEMATIKA
ANGOL NYELVEN**

**KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA**

2019. május 7. 8:00

I.

Időtartam: 57 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

EMBERI ERŐFORRÁSOK MINISZTERIUMA

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. Solve the following equation in the set of real numbers.

$$x^2 + x - 2 = 0$$

	2 points	
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2. Five people were sitting around a table at a wedding. Each of them were asked how many of the other four they were acquainted with (all acquaintances are considered mutual). The answers of four of them were 4, 4, 4, 3. How many acquaintances did the fifth person have sitting at the table?

	2 points	
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3. Give the value of x if $2^{16} = 16^x$.

	2 points	
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4. The volume of a bottle that is shaped like a cylinder is 1 litre. Its height is 20 cm. Calculate the radius of the base circle of the cylinder. Show your work.

	3 points	
	1 point	

5. Determine the truth value of the following statements (true or false):

A: If a number is divisible by 12 then it is also divisible by 6.

B: If a number is divisible by 3 then it is also divisible by 6.

C: A number is divisible by 6 if and only if it is divisible by both 2 and 3.

A: B: C:	2 points	
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6. Determine the greatest common divisor of $2^3 \cdot 3 \cdot 7^4 \cdot 19$ and $2^5 \cdot 7^2 \cdot 19$.

	2 points	
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7. The function $x \mapsto 2(x-1)^2 + 5$ is defined over the set of real numbers. Determine where this function has its minimum and also the minimum value.

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

8. Give the number that is 2 less than its own absolute value.

	2 points	
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9. The function $x \mapsto \sin x$ is defined over the interval $[0; 2\pi]$. Determine the zeros of this function.

	2 points	
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- 10.** The first term of a geometric sequence is 2, the fourth term is 54.
Give the sum of the first five terms of this sequence. Show your work.

	3 points	
	1 point	

- 11.** The equation of a circle is $x^2 + y^2 - 6y + 9 = 25$. Determine the coordinates of the centre and also the radius of this circle.

The centre:	2 points	
The radius:	1 point	

- 12.** There are 14 girls in a class of 32. Two students are selected at random from this class. What is the probability that both of them will be girls? Show your work.

	2 points	
	1 points	

		score	
		maximum	maximum
Part I	Question 1	2	
	Question 2	2	
	Question 3	2	
	Question 4	4	
	Question 5	2	
	Question 6	2	
	Question 7	2	
	Question 8	2	
	Question 9	2	
	Question 10	4	
	Question 11	3	
	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!

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ANGOL NYELVEN**

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ÍRÁSBELI VIZSGA**

2019. május 7. 8:00

II.

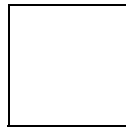
Időtartam: 169 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

EMBERI ERŐFORRÁSOK MINISZTERIUMA

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. Two groups of people are visiting the city Zoo. One group is paying a total of 4300 forints for 1 adult and 4 child tickets, while the other pays 6350 forints for 2 adult and 5 child tickets.

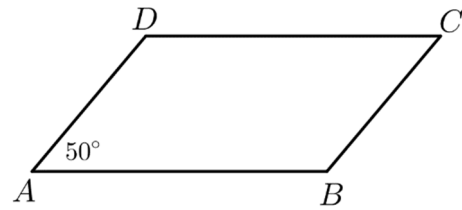
a) Calculate the price of one adult ticket and the price of one child ticket.

The gross ticket price, paid by the customer, is the sum of the net price and the VAT (value added tax). The VAT is 27% of the net price.

b) How many forints of VAT does the 6350 Ft gross ticket price contain and what percentage of the gross price is this VAT?

a)	6 points	
b)	5 points	
T.:	11 points	

14. Side AB of parallelogram $ABCD$ is 5 cm, side AD is 3 cm long. The angle at vertex A of the parallelogram is 50° .



- a) Calculate the height that belongs to side AB of the parallelogram and also the area of the parallelogram.
- b) Calculate the length of diagonal AC of the parallelogram.
- c) Let \mathbf{a} be the vector \overrightarrow{AD} and \mathbf{b} the vector \overrightarrow{DB} . Express vectors \overrightarrow{AC} and \overrightarrow{CD} in terms of vectors \mathbf{a} and \mathbf{b} .

a)	4 points	
b)	4 points	
c)	4 points	
T.:	12 points	

15. In a random experiment two fair dice are rolled at the same time. This experiment is repeated several times. After each roll the sum of the two numbers shown is recorded. This sum is considered to be the outcome of the experiment. Here are the sums recorded after the first nine rolls: 9, 3, 5, 4, 11, 6, 9, 6, 10.

- a) Calculate the range, median, mean, and standard deviation of the above set of nine numbers.

Let A be the event that the outcome of the experiment is greater than 4 but less than 9.

- b) Give the relative frequency of event A after the first nine experiments.
- c) Calculate the probability of event A .

a)	5 points	
b)	2 points	
c)	6 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.

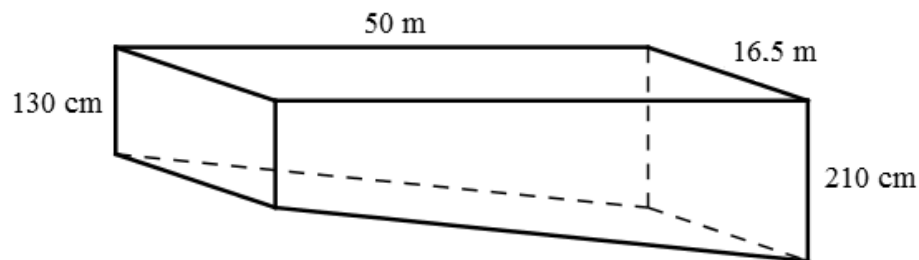
- 16.** The daily temperature maximums and also the number of tickets sold each day were both recorded at a beach throughout the days of a summer week. The records are shown in the table below.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
daily temperature maximum (°C)	31	28	27	31	32	33	28
number of tickets sold	1246	1315	1167	1275	1358	2617	1786

The following statement refers to the data in the table: *If the daily temperature maximum is higher than 30 °C then the number of tickets sold that day is more than 1200.*

- a) Determine the truth value of this statement (true or false). Explain your answer.
- b) Give the converse of the statement and determine the truth value of the converse. Explain your answer.

One of the pools on this beach is 50 metres long, 16.5 metres wide, 130 centimetres deep on one end and 210 centimetres deep on the other. The pool is getting deeper at a constant rate from one end to the other.



- c) What is the maximum amount of water this pool can hold?
Round your answer to the nearest ten cubic metres.

A contest is organised in this pool for 8 participants of a swimming camp. Contestants are assigned randomly to the 8 lanes of the pool.

- d) Calculate the probability that Matyi and Sári, two of the contestants, will swim in adjacent lanes.

a)	2 points	
b)	3 points	
c)	6 points	
d)	6 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 terms of a certain progression are the positive integers (in increasing order) that give a remainder of 1 when divided by 3. Calculate the 56th term of this progression and determine which term of the progression is 1456.
- b) Give the equation of the line that passes through the point $A(14; 56)$ and is perpendicular to the line $y = 3x + 1$.
- c) The function $x \mapsto 3 \cdot |x + 1|$ is defined over the closed interval $[-14; 56]$. Give the range of the function.

a)	6 points	
b)	5 points	
c)	6 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.** To make computer passwords safer they should consist of as many characters as possible and they should contain as many of the following three types of characters as possible:
- capital letters (of the English alphabet: 26 different options),
 - small case letters (also 26 different options),
 - numerical digits (0, 1, ..., 9).

Brute Force is a computer application that goes through 15 million different passwords per second.

András's password is type **A**: insecure. These passwords consist of 6 different numerical digits.

- a)** How long does it take for Brute Force to go through all possible type **A** passwords?

Balázs's password is moderately secure, type **B**. These passwords consist of eight small case letters. Cili's password is secure, type **C**. Such passwords consist of ten letters, two of which are capitals, while the other eight are small case. (Both type **B** and type **C** passwords may contain identical characters.)

- b)** How many times longer will it take for Brute Force trying all type **C** passwords than it would take trying all type **B**-s?

A computer program compares the security level of various passwords. The level of any given password will be compared to the level of all the other passwords entered into the program. (The program will make only one comparison for any pair of passwords.) At one time this program was used to compare a certain number of passwords, making less than 900 comparisons altogether.

- c)** What is the maximum number of passwords the program compared?

Encryption algorithms often use large prime numbers. A news article at the beginning of 2018 stated that the largest prime discovered so far was calculated as $2^{77\ 232\ 917} - 1$.

A mathematics website writes: *"To determine the number of digits of a positive integer in decimal form, the base 10 logarithm of that number must be calculated first. The smallest of all integers greater than this logarithm will be the number of digits of the original number."*

- d)** Use the above method to show that the number of digits of $2^{77\ 232\ 917}$ (written in decimal form) is 23 249 425.

a)	4 points	
b)	4 points	
c)	6 points	
d)	3 points	
T.:	17 points	

	number of question	score		
		maximum	awarded	total
Part II A	13	11		
	14	12		
	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