Név: osztály:.....

ÉRETTSÉGI VIZSGA • 2023. máius

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

minden vizsgázó számára

2023. május 9. 9:00

I.

Időtartam: 57 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

OKTATÁSI HIVATAL

Név:	 osztály:
I TOV.	 OSZIGI y

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. Given are two sets: $A = \{a; b; e; g\}$ and $B = \{a; b; c; d; f\}$. By listing its elements, give the set $B \setminus A$.

 $B \setminus A =$ 2 points

2. Bori, Kristóf and Marci are playing a role-playing card game. At the beginning of the game they each select one out of 10 role cards, without replacement. In how many different arrangements of the roles can the game begin?

2 points

3. Zita's salary has been raised from 275 000 Ft to 308 000 Ft. By what percentage has Zita's salary been raised?

2 points

4. In triangle $\overrightarrow{AB} = \mathbf{b}$, $\overrightarrow{AC} = \mathbf{c}$. The midpoint of side \overrightarrow{AB} is point F, the midpoint of side AC is G. Express vector \overrightarrow{FG} in terms of vectors \mathbf{b} and \mathbf{c} . Explain your answer.

	2 points	
\overrightarrow{FG} =	1 point	

5. Give five positive numbers such that their median is 3 and their range is 7.

2 points

6. Determine the decimal (base 10) value of the binary (base 2) number 101011.

2 points

7. It is known that $\log_2 x = 5$. Give the value of $\log_2(2x)$. Explain your answer.

1 point	
1 point	

8. List all integer values of x for which both of the inequalities $-6 \le x \le 2$ and -4 < x < 10 are true.



9. Sixteen teams have signed up for the school indoor football championship. In how many different ways can the two teams playing the opening game be selected?

2 points

10. The sides of the right triangle ABC are a = 7, b = 24, c = 25 units long. Calculate the length of the height that belongs to the hypotenuse. Explain your answer.

3 points	
1 point	

- **11.** Given is line *e*: 5x y = 7.
 - a) Give one normal vector of line e.
 - **b)** Give the equation of the line that passes through the point P(3; 2) and is parallel to line e.

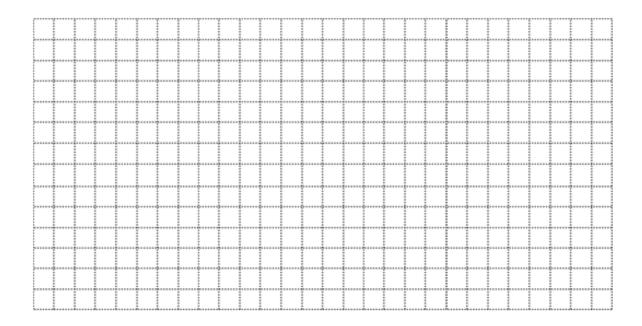
a)	1 point	
b)	2 points	

12. Function f below is defined over the set of non-negative real numbers. Functions g and h are defined over the set of real numbers.

$$f(x) = \sqrt{x} - 2$$
 $g(x) = (x - 2)^2 - 3$ $h(x) = 2\sin x$

For each of the statements below indicate the appropriate function(s) for which that particular statement holds true.

The minimum value of the function is (-2):	2 points	
The function has at least two zeroes:	2 points	



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

date	examiner

		pontszáma egész számra kerekítve	
		elért	programba beírt
I. rész			
dátum	_	dátı	ım
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!

Név: osztály:.....

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MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

minden vizsgázó számára

2023. május 9. 9:00

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 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

- **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!

awarded.

Név:	osztály:

- **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. The numbers 1, 2, 3, 4, 5 and 6 have been written on a sheet of paper. Any two of these numbers are connected with a line (edge) if and only if one number is a divisor of the other (none of the numbers are connected to themselves). This will give a 6-point graph.

6 5

1

2 3

- a) Draw this graph.
- **b)** Determine the truth value of the following two statements (true or false). Explain your answer.
 - I. There exists a positive integer that has exactly 4 positive divisors.
 - II. If the integer n is not a divisor of the integer m then n and m are relative primes (co-primes).

Consider the following two events:

- A: Roll a fair gambling dice once, the number shown is a divisor of 24.
- B: Roll a fair gambling dice twice, none of the numbers shown is a 6.
- c) Which of the two events has a higher probability?

a)	3 points	
b)	4 points	
c)	5 points	
Т.:	12 points	

Matematika angol nyelven középszint	Név:	osztály:

14. In a physics class, students were experimenting in pairs, measuring the acceleration of an object sliding down a slope. Each of the six pairs measured the acceleration four times. Here are the results obtained by Emma and Norbi:

	trial 1	trial 2	trial 3	trial 4
acceleration (m/s ²)	1.9	2.0	1.8	2.3

a) Calculate the standard deviation of the four results Emma and Norbi obtained.

The average of the 20 values obtained by the other five pairs is exactly 1.9 m/s².

b) What is the average of the 24 results of the six pairs? Round your answer to two decimal places.

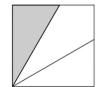
In another experiment, students examined the motion of a ball that had been shot vertically upwards from the ground and then fell back. According to their results, the distance h of the ball from the ground follows the rule $h(t) = 6t - 5t^2$, where t is the time passed since the ball has been shot upwards. (Time values are measured in seconds, distances in metres.)

- c) According to the formula above, how high above the ground is the ball 0.5 seconds after it has been shot upwards?
- **d)** How many seconds after it has been shot upwards will the ball reach a height of 1 m above the ground?

a)	3 points	
b)	4 points	
c)	2 points	
d)	3 points	
T.:	12 points	

Matematika angol nyelven középszint	Név:	osztály:

15. The side of a square is 4 cm. Two line segments are drawn into this square such that they trisect one of the right angles of the square.



a) Calculate the area of the triangle shaded grey in the diagram.

Select one interior point of a square of the same size and connect it to the four vertices, as seen in the diagram. The triangles obtained will be coloured in either blue, green or yellow. All three colours must be used and each triangle is coloured in a single colour. No adjacent triangles (sharing a common side) may be coloured the same.



b) In how many different ways can the square be coloured if the above rules are followed?

Consider the sums of the areas of the opposite triangle pairs drawn into the square of side 4 cm.



c) Prove that the sums of the areas of the opposite triangle pairs are equal, i.e. the total area shaded grey in the diagram is equal to the total white area.

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

Matematika angol nyelven középszint	Név:	osztály:

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

a)
$$2 \cdot \sqrt{3-x} = x+5$$

b)
$$\frac{x}{x+1} + \frac{x^2}{x^2 - 1} = 2$$

The first term of an arithmetic sequence is 18. The sum of the first six terms of the sequence is equal to the sum of the first seven terms.

c) Show that the sum of the first 13 terms of the sequence is 0 and calculate the 13th term of the sequence.

a)	6 points	
b)	5 points	
c)	6 points	
Т.:	17 points	

Matematika angol nyelven középszint	Név: osztály:

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.** In the year 2018 factory *A* produced goods worth 500 million forints, while factory *B* produced goods worth 400 million forints. According to their long-term plans, factory *A* will increase production by 5% each year, while factory *B* will increase production by 6% per year.
 - a) Calculate the total worth, in million forints, of the goods produced in factory A in the next 20 years (from 2019 to 2038) altogether.

The above plans were published on an economy website. A debate started in the comment section of the article: one user claimed that the difference between the volumes of production between the two factories would get smaller and smaller in the next couple of years.

b) Calculate the missing values of the table below and show that the above claim is not true.

	2018	2019	2020	2021
production volume of factory A (million Ft)	500			
production volume of factory <i>B</i> (million Ft)	400			

According to another user the opposite is true: the difference between the production volumes would actually grow, the production volume of factory B will never be more than that of factory A. A third user claimed this was not true either.

c) Calculate the year in which the production volume of factory B will reach the production volume of factory A. (Assuming the increase in production will, in fact, follow the plans.)

a)	4 points	
b)	6 points	
c)	7 points	
Т.:	17 points	

Matematika angol nyelven		
Matematika angol nyelven középszint	Név:	osztály:

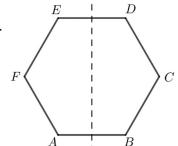
You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 2.

- **18.** *Magic Spheres* dessert is sold in boxes that have a shape of a regular hexagon-based prism. Each edge of the regular hexagonal base is 5 cm long and the height of the box is 3 cm. The box contains 6 chocolate balls, each has a diameter of 2.8 cm.
 - a) What percentage of the volume of the box is the volume of the chocolate?

Chocolate balls in *Magic Spheres* dessert are individually wrapped in either gold or red wrapping foil. The sorting machine randomly drops the chocolate balls into the boxes, the probability of a red one is $\frac{1}{3}$, the probability of a gold one is $\frac{2}{3}$, a total six chocolate balls in each box.

b) Calculate the probability that at least 5 of the 6 chocolate balls in a box will be wrapped in gold foil.

Each side of the regular hexagon ABCDEF is 5 cm long. The hexagon is rotated around the perpendicular bisector of side AB.



c) Calculate the volume of the resulting solid.

a)	7 points	
b)	5 points	
c)	5 points	
Т.:	17 points	

Matematika angol nyelven		
Matematika angol nyelven középszint	Név:	osztály:

	number of score			
	question	maximum	awarded	total
Part II A	13.	12		
	14.	12		
	15.	12		
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

javító tanár	jegyző

dátum