

ÉRETTSÉGI VIZSGA • 2025. október 14.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2025. október 14. 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. When 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 out, 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 over the set of real numbers.

$$x^2 - 5x + 6 = 0$$

	2 points	
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2. In the equation below $a = 11$, $b = 5$ and $c = 2$. Calculate the value of t .

$$a = b + c \cdot t$$

$t =$	2 points	
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3. Determine the truth value (true or false) of the following statements.

- I. If two rhombuses have equal areas then the two rhombuses are congruent.
- II. If the diagonals of a parallelogram are equal in length then this parallelogram is a rectangle.
- III. If two vectors are parallel and also equal in length then these two vectors are equal.

I. II. III.	2 points	
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4. A graph has seven vertices, each with a degree of 4. How many edges does this graph have?

The number of edges is:	2 points	
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5. From among the expressions below, select the one that is equivalent to $b^{\frac{2}{3}}$ for all positive values of b .

A: $\frac{2}{3}b$

B: $b^{-\frac{3}{2}}$

C: $\sqrt[3]{b^2}$

D: $\frac{b^2}{b^3}$

	2 points	
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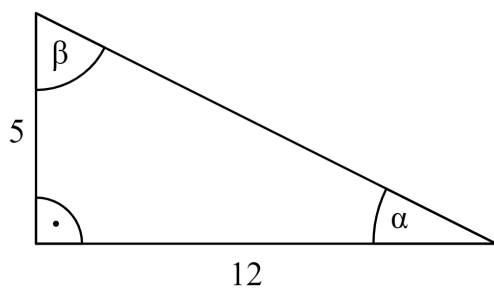
6. Four people are waiting in front of a classroom: the class tutor and three students. In how many different orders may they enter the classroom if the tutor must be either first or last?

	2 points	
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7. Consider the following sets: $A = \{1; 2; 3; 5; 7\}$, $B = \{1; 3; 5; 7; 9\}$, $C = \{1; 4; 9\}$.
Give the sets $A \cup B$ and $(A \cap B) \setminus C$ by listing their elements.

$A \cup B =$	1 point	
$(A \cap B) \setminus C =$	2 points	

8. The legs of a right triangle are 5 cm and 12 cm long.
Give the measure of each acute angle of this triangle. Show your work.



	1 point	
$\alpha =$	1 point	
$\beta =$	1 point	

9. A certain function is defined over the set of real numbers. To each real number it assigns the value that is three more than twice the original number. What value does this function assign to 7?

	2 points	
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10. The radius of the base of a cone is 3 cm, its height is 4 cm. Calculate the surface area of the cone. Show your work.

	2 points	
The surface area is: cm^2 .	1 point	

11. Calculate the mean and the standard deviation of the numbers 0, 1, 1, 2, 3, 5.

The mean:	1 point	
The standard deviation:	2 points	

- 12.** Two fair gambling dice are rolled at the same time. Calculate the probability that the sum of the two numbers shown will be divisible by 6. Show your work.

	3 points	
	1 point	

		score	
		maximum	awarded
Part I	Question 1	2	
	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	3	
	Question 11	3	
	Question 12	4	
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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MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2025. október 14. 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. When 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 in answering the questions. 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 **is acceptable 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 *Négyjegyű függvénytáblázat* (Formula 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. When 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 out, 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

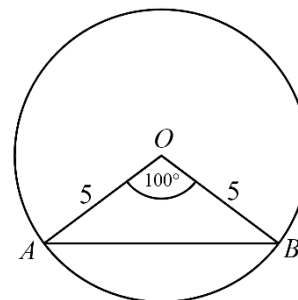
- 13.** a) The second term of an **arithmetic** sequence is 7, the fourth term is 13.
Determine the tenth term of this sequence as well as the sum of the first ten terms.
- b) The second term of a **geometric** sequence is 6, the fifth term is -162 .
Determine the tenth term of this sequence as well as the sum of the first ten terms.

a)	6 points	
b)	6 points	
T.:	12 points	

Név: osztály:.....

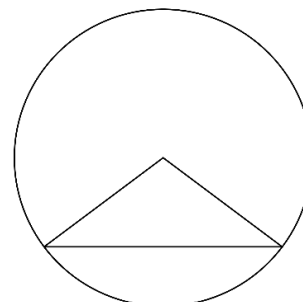
- 14.** The length of the radius of a circle centred at O is 5 cm. Chord AB of this circle subtends a 100° central angle.

- Calculate the length of chord AB .
- Calculate the area of triangle OAB .
- Calculate the length of the arc AB subtended by the 100° central angle.



The three regions of the diagram shown on the right will be coloured in red, yellow and green, such that either two or three of these colours are used. (Each region is coloured in a single colour, adjacent regions may be of the same colour.)

- How many different ways are there to colour the diagram with respect to the above rules?



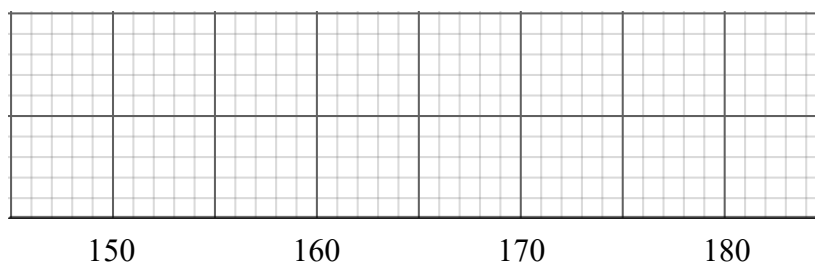
a)	2 points	
b)	2 points	
c)	2 points	
d)	5 points	
T.:	11 points	

Név: osztály:.....

- 15.** There are 14 girls in class 11.b, their heights, measured in centimetres, listed in increasing order as below: 153, 156, 160, 162, 162, 164, 167, 169, 169, 172, 174, 174, 175, 177.

- a)** Use the data given to fill in the table and show the distribution of the heights on a box-plot (box-and-whisker plot).

minimum	cm
lower quartile	cm
median	cm
upper quartile	cm
maximum	cm



Two of the girls attending class 11.b are randomly selected.

- b)** Determine the probability that one of the girls selected is taller and the other is shorter than 170 cm.

There are a total 28 students in class 11.b. The mean height of these students is 172.75 cm. A new student of height 180 cm arrives.

- c)** What is the mean height of the students of this class after the arrival of the new student?

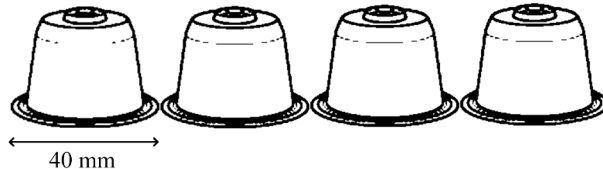
a)	5 points	
b)	4 points	
c)	4 points	
T.:	13 points	

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.** People in the world use about 56 billion coffee capsules each year. An environmental protection website¹ states that these 56 billion capsules, lined up next to one another, would make 57 times the length of the Equator.



- a)** Assume the width of a single capsule is 40 mm. Prove, by calculation, that the above statement is true, with reasonable approximation. (The approximation is reasonable if the result obtained is anywhere between 55 and 59. Consider the Equator as a circle of radius 6370 km.)

The inside of one of these coffee capsules can be approximated with a truncated cone with the following measures: the diameter of the base circle is 28 mm, the radius of the top circle is 24 mm, the slant height (generator) is also 28 mm.

- b)** How much coffee could this capsule hold?
Give your answer in cubic centimetres, rounded to the nearest integer.

The inside of another type of capsule can be approximated with a hemisphere with a volume of 10 millilitres.



- c)** Calculate the radius of the hemisphere.

A machine is used to manufacture coffee capsules. About one out of a thousand capsules made by this machine is defective. (This may be interpreted as a 0.001 probability for any particular, randomly selected capsule to be defective.)

- d)** Determine the probability that, out of 100 randomly selected capsules, none will be defective.

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

¹ <https://www.greenmatch.co.uk/is-coffee-pods-and-capsules-bad-for-environment> (Last access: 09.09.2025.)

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.** An optician's shop offers a discount off the standard price of spectacle frames by a percentage corresponding to the age of the customer in years.

- a) The price of a frame is 30 000 Ft without the discount. How much would the discounted price be for a 37-year-old customer?
- b) What is the age, in years, of a customer who paid a discounted price of 16 500 Ft for a frame that originally cost 30 000 Ft?

Péter's grandmother is three times as old as Péter. If they each bought a 30 000-forint frame at discounted prices, Péter would pay three times as much as his grandmother would.

- c) Give Péter's age and his grandmother's age in years.

The ratio of boys to girls in a graduating class of 32 students is 5 : 3. There are 11 students in this class who wear glasses, 7 of whom are boys. There are 3 students in the class, all three of them girls, and one of them wearing glasses, who have not had their 18th birthday by the day of the Mathematics final exams.

- d) How many girls are there in the class who do not wear glasses and are over 18 by the day of the exam?

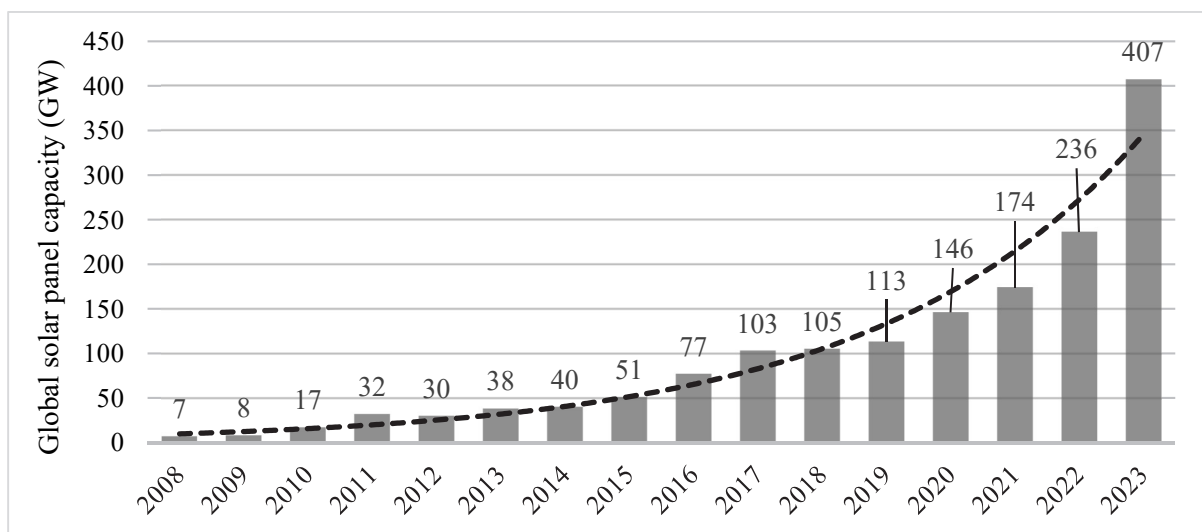
a)	2 points	
b)	3 points	
c)	7 points	
d)	5 points	
T.:	17 points	

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.** As part of a project assignment, Anna has been studying global solar panel capacities between the years 2008 and 2023.² She entered the data for this time period into a spreadsheet program that fitted an exponential best-fit curve (trendline) on these. The equation of the curve fitted is: $y = 7.67 \cdot 1.27^x$.

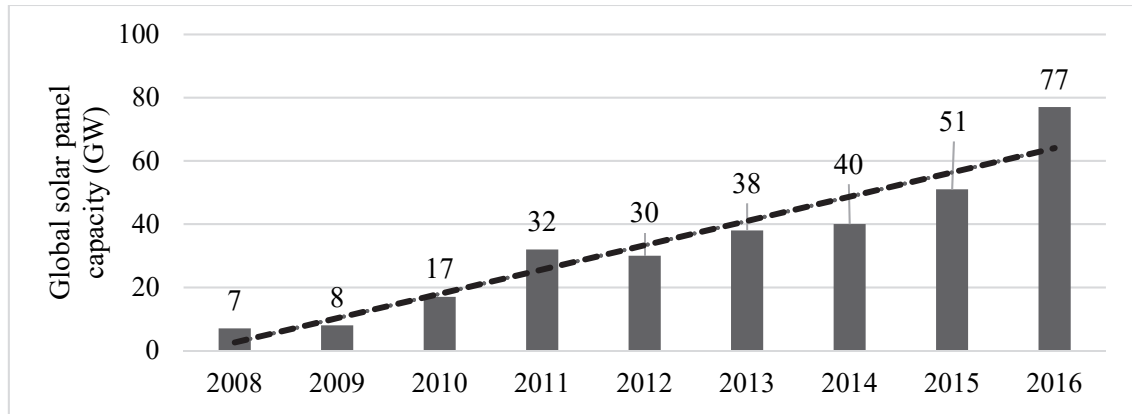
In this formula x represents the number of years **since 2007**, and y represents the global solar panel capacity in gigawatts (GW). (Global solar panel capacity refers to the combined power output of all solar powers in operation on the Earth.) Anna's data for subsequent years, as well as the exponential best-fit curve (trendline) are shown in the diagram below.



- Calculate how much the value given by the equation of the trendline for the year 2020 differs from the actual value for 2020, shown in the diagram.
- Calculating from the equation of the trendline give the annual percentage increase of global solar panel capacities between the years 2008 and 2023.
- Based on the equation of the trendline determine the year in which global solar panel capacities first reach 3000 gigawatts.

² <https://iea-pvps.org/wp-content/uploads/2024/04/Snapshot-of-Global-PV-Markets-1.pdf>
(Last access: 09.09.2025.)

Between the years 2008 and 2016 the increase in capacity was more moderate. For this period, the equation of the linear best-fit line determined by the program is: $y = 7.7x - 5$, where x represents the number of years **since 2007**, and y represents the global solar panel capacity in gigawatts (GW). Both the data and the trendline are shown in the diagram below.



- d) By what percentage is the value given by the linear formula for the year 2016 smaller than the actual value for 2016, shown in the diagram?

Anna would like to know how far the equation of the line fitted exclusively on the first (2008) and ninth (2016) data points resembles the linear equation given by the program.

- e) Write down the equation of the line through the points (1; 7) and (9; 77).

a)	3 points	
b)	2 points	
c)	4 points	
d)	4 points	
e)	4 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