ÉRETTSÉGI VIZSGA • 2024. május 7.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2024. május 7. 9:00

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.** List all positive divisors of 28.

	2 points	

2. Give the sum of the interior angles of a regular octagon (8 sides).

	2 points	

3. The amount of data in the databanks of a newly founded informatics firm doubles roughly every 10 days. Determine the number of days until the amount of data becomes eight times of what it is now.

	2 points	

4. The diagram below shows the distribution of the shoe sizes of 25 students.
Use the diagram to determine the mean, mode and median of the data.
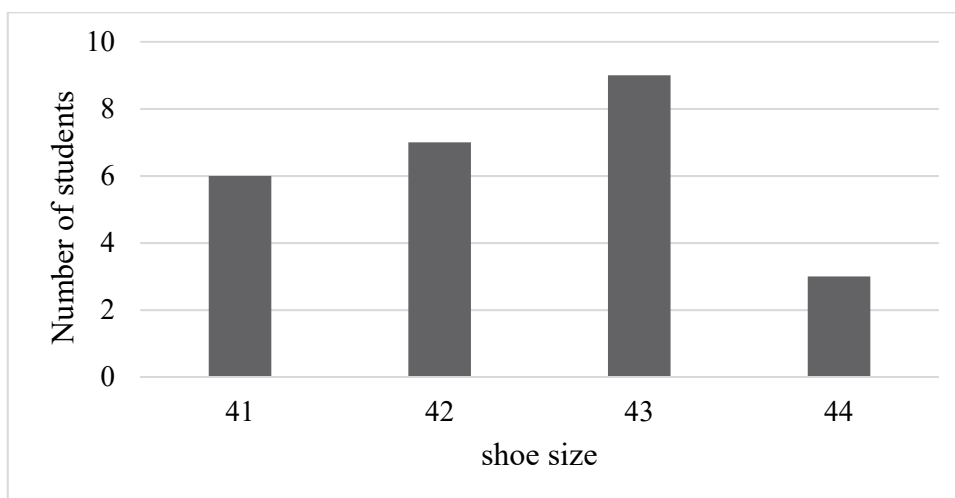
The mean:	2 points	
The mode:	1 point	
The median:	1 point	

5. There are 16 students in a study group. Two of them are selected to solve a problem together at the board. How many different ways are there to select the 2 students from the group, working at the board?

	2 points	

6. Point *F* is the midpoint of side *BC* in triangle *ABC* shown in the diagram. Let vectors **p** and **q** represent the side vectors from vertex *A*, as show in the diagram.

Express, in terms of **p** and **q**, the vectors $\overrightarrow{CB}$, $\overrightarrow{CF}$ and $\overrightarrow{BA}$.
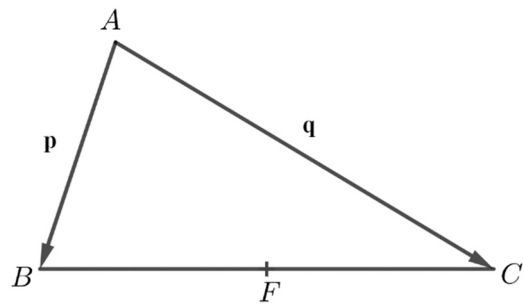
$\overrightarrow{CB} =$	1 point	
$\overrightarrow{CF} =$	1 point	
$\overrightarrow{BA} =$	1 point	

7. The note on a box of cartilage care pills gives the mass of each pill as 1.57 grams. The mass of the empty box is 24.7 grams. The mass of the box full of pills is 166 grams. How many pills are there in the full box? Show your work.

	2 points	
	1 point	

8. Consider the following statement (for positive integers):
"If the product of two numbers is odd then the sum of these two numbers is even."
Give the converse of the statement and determine the logical value of the converse (true or false).

The converse of the statement:	1 point	
The logical value of the converse:	1 point	

9. A bank pays an annual compound interest of 6% on all deposits. By what percentage does the value of a certain deposit increase in 3 years?

	2 points	

10. The equation of a line is $y = \dfrac{2}{3}x - 2$. Point P is a point on this line. The second coordinate of point P is 2. Give the first coordinate of point P.

	2 points	

11. The function $f(x) = \left(\dfrac{1}{2}\right)^{1-x}$ is defined over the set of real numbers.

Calculate the value of function f when $x = 3$.

	2 points	

12. One of the two-digit, positive integers is randomly selected. Determine the probability that the number selected is divisible by 11. Show your work.

	3 points	
	1 point	

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

ÉRETTSÉGI VIZSGA • 2024. május 7.

MATEMATIKA ANGOL NYELVEN

# KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2024. május 7. 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.
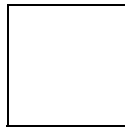
4. On solving the problems, you may use a calculator that cannot store and display textual information. You may also use any edition of the four-digit data tables. The use of any other electronic device or printed or written material is forbidden!

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 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)** A customer bought 4 kg of potatoes and 3 kg of onions for a total 1570 forints at a grocery stall at the market. The next customer at this stall bought 2 kg of potatoes and 1 kg of onions for 700 forints. What is the price of 1 kg of potatoes and how much does 1 kg of onions cost at this stall?

b) Solve the following equation over the set of real numbers.

$$4 + 2x(x-1) = (x+1)^2$$

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

14. Dóri used play-dough to make a cylinder whose base diameter is 6 cm and height is 10 cm. Later on, her sister, Panni, used the same amount of dough to make a "snake", also shaped like a cylinder, but this was 40 cm long.

a) Determine, in centimetres, the diameter of Panni's "snake".

The next day Dóri used a mould to make pyramids out of the play-dough. One of the pyramids had a square base with 8 cm edges, while all the lateral edges were 9 cm long.
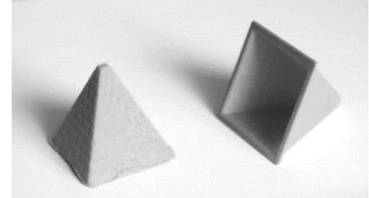
**b)** Calculate the volume of this pyramid.

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

15. Three branches grew off the trunk of a newly planted tree. By the end of the first year each of these branches forked into two new branches. The diagrams below show the structure of the tree as graphs at the time of planting and also at the end of the first year. Points where branches fork and also those at the ends of branches are considered as the vertices of the graphs, while the branches themselves are considered as edges (the trunk of the tree is also considered an edge).
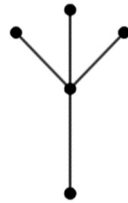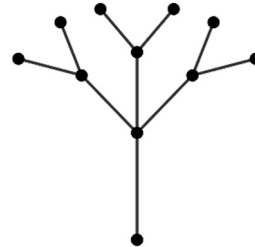
at the time of planting   at the end of the first year

a) How many edges and how many vertices does the graph have at the end of the first year?

By the end of the second year, each branch of the first year forked again into two new branches. And so on, by the end of each new year, every branch of the previous year forks into two new branches.

b) How many edges are there on the graph that represents the tree at the end of the fourth year?

Tree saplings are planted, in 17 rows, in a trapezium-shaped garden. There are 12 saplings in the first row, 15 in the second, 18 in the third, and so on: there are 3 more saplings in each row than there are in the one before.

c) How many tree saplings are there in the last row and how many saplings are there, altogether, in the garden?

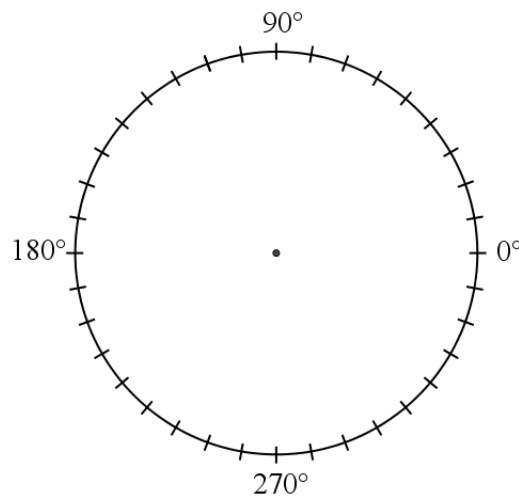|		
a)	2 points	
b)	5 points	
c)	5 points	
T.:	12 points	

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. While practicing for the Mathematics exam, Hajni drew graphs of absolute value, linear, quadratic and radical functions, a total of 24 of them altogether. We would like to show the distribution of these functions on a pie chart, using data from the following table.

| Type of function	Number of functions drawn	central angle
Absolute value function	5	
Linear function		135°
Quadratic function	6	
Radical function		

a) Fill in the blank cells of the table and draw the pie chart.

One of the quadratic functions Hajni drew was $f(x) = (x-3)^2 - 4$, where $x \in \mathbf{R}$.

b) Describe the function *f* in terms of zeros, monotonicity, extreme values (type, location and value), range.

|		
a)	7 points	
b)	10 points	
T.:	17 points	
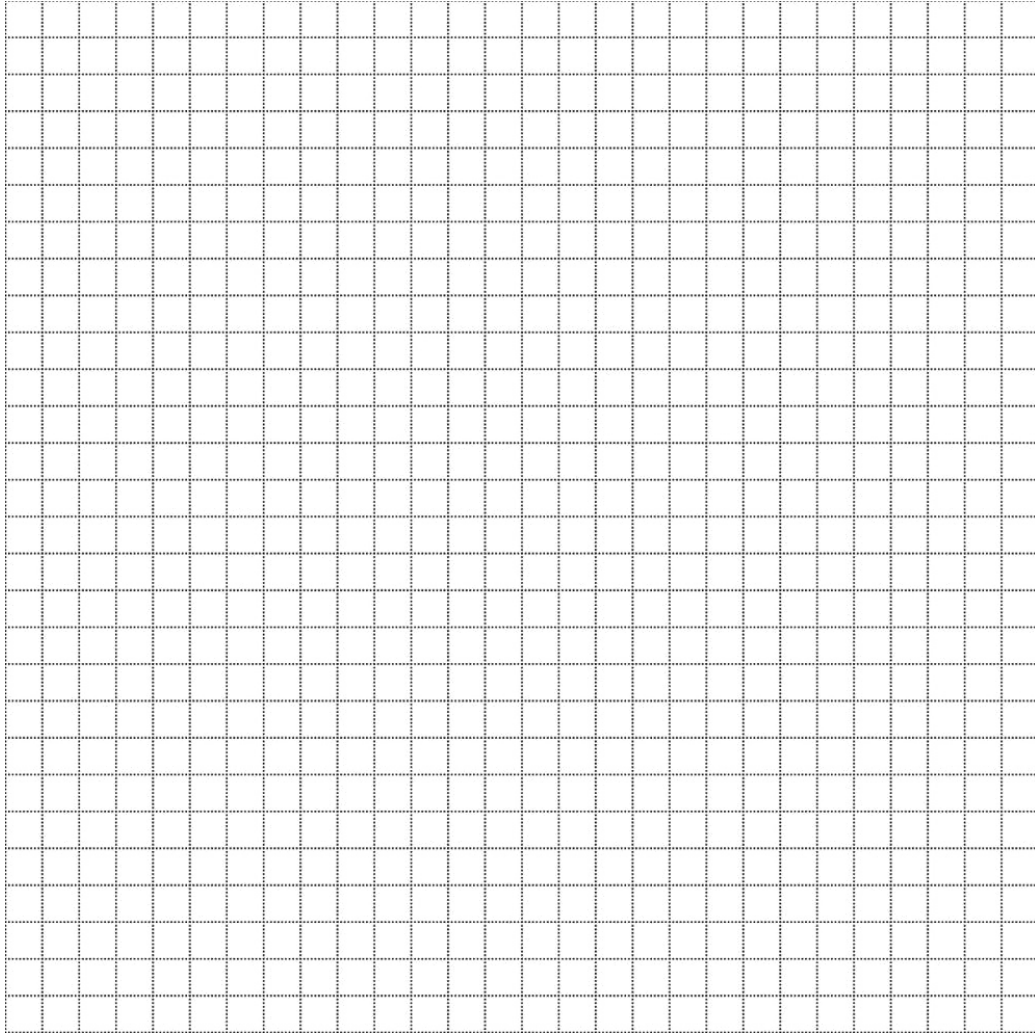
You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 2.

17. The lengths of the sides of triangle *ABC* are *AB* = 40 cm, *AC* = 25 cm and *BC* = 35 cm. Point *D* is an interior point on side *AC*, such that the length of segment *BD* is also 35 cm. Let α be the interior angle at vertex *A* of triangle *ABC*.
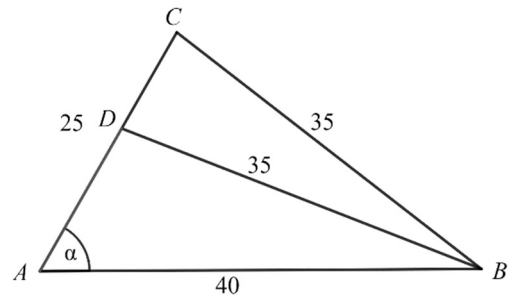
    a) Prove by calculations that α = 60°.

    b) Determine the area of the obtuse triangle *ABD*.

The diagram shows the road network between four towns (*A, B, C* and *D*). The driver of a road safety car would like to travel along all five roads, such that each road is travelled only once. One such possible route is *DABDCB*.
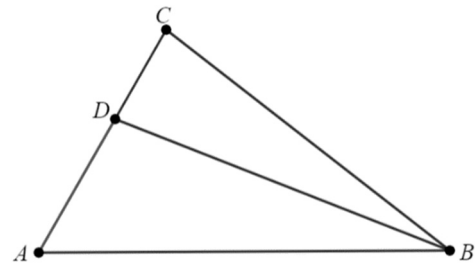
    c) How many different possible routes can be made that start from point *B*?
(Two routes are considered different if at least one town is at a different position in one of them than in the other.)

    d) Determine the truth value of the following statements (true or false). You do not need to justify your answers here.

        (1) The complete graph that has 4 vertices has 6 edges.
        (2) There exists a graph with 5 vertices where the valence (degree) of each vertex is 3.
        (3) There exists a graph with 6 vertices that has 5 edges.

a)	4 points	
b)	7 points	
c)	4 points	
d)	2 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. A school has both a dance club and a pottery club. Of the 142 students in this school, 24 are members of the dance club and 20 are members of the pottery club. There are 8 times as many students attending neither club as there are students attending both.

    a) How many students attend the dance club only and how many students attend the pottery club only?

There were 8 students attending a particular session of the pottery club. This session took place in a room that seated 16 people in eight desks of two students each. At the beginning of the session the teacher asked the students to sit apart, such that there would only be one person sitting per desk, at either of the two spaces.

    b) How many different seating arrangements are possible following these rules? (Two seating arrangements are considered different if there is at least one student sitting at a different place.)

At another time, there were 14 students attending the dance club session, 6 of whom were also members of the pottery club.

    c) Three of these 14 students are selected at random. Calculate the probability that, among the 3 students selected, there will be exactly 2 who are also members of the pottery club.

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

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

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

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date

_____
examiner

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

_____
dátum

_____
dátum

_____
javító tanár

_____
jegyző