

**MATEMATIKA
ANGOL NYELVEN
MATHEMATICS**

**KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA
STANDARD LEVEL
WRITTEN EXAMINATION**

I.

Időtartam: 45 perc
Time allowed: 45 minutes

Number of extra sheets Pótlapok száma	
Tisztázati / Final version	
Piszkozati / Draft	

**OKTATÁSI MINISZTERIUM
MINISTRY OF EDUCATION**

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Instructions to candidates

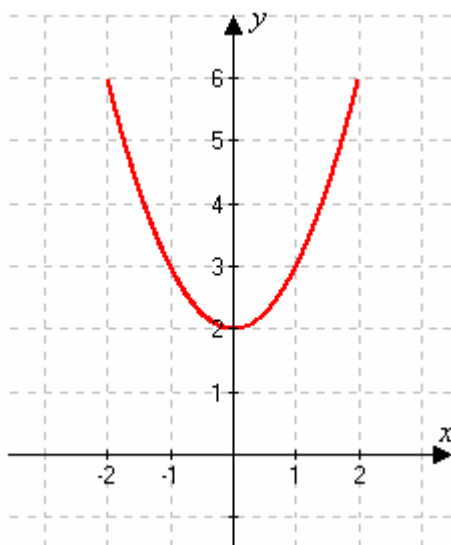
- The time allowed for this examination paper is 45 minutes. When that time is over, you will have to stop working.
- You may solve the problems in any order.
- In solving the problems, you are allowed to use a calculator that cannot store and display verbal information. You are also allowed to use four-digit data tables. The use of any other electronic devices or printed material is forbidden!
- **Write the final answers in the appropriate frames.** You are not required to write down details of the solutions, except where you are instructed by the problem to do so.
- Write in pen. Diagrams are also allowed to be drawn in pencil. If you cancel any solution or part of a solution by crossing it over, it will not be assessed.
- Only one solution to each problem will be assessed.
- Please do not write anything in the grey rectangles!

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1. Two points, $A\left(-4; \frac{1}{2}\right)$ and $B\left(1; \frac{3}{2}\right)$ are given in the plane. Find the coordinates of the midpoint of the line segment AB .

The coordinates of the midpoint:	2 points	
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2. The graph of a function whose domain is the interval $[-2; 2]$ is shown in the diagram below. Select the correct assignment rule of the function out of the ones listed.



A: $x \mapsto x^2 - 2$.

B: $x \mapsto x^2 + 2$.

C: $x \mapsto (x + 2)^2$.

The letter of the correct answer:	2 points	
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3. Determine the range of the function given in question 2 defined on the interval $[-2; 2]$.

The range:	3 points	
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4. Decide whether each of the following statements is true or false.

A: The centre of the circumscribed circle of a triangle always lies on one of the medians of the triangle.

B: A quadrilateral may have an interior angle greater than 180° .

C: Every trapezium is a parallelogram.

A:	1 point	
B:	1 point	
C:	1 point	

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5. The radius of a circle is 4, its centre is the point $(-3; 5)$. Find the equation of the circle.

The equation of the circle:

2 points

6. 150 raffle tickets were sold at a party. Agnes bought 21 of them. What is the probability of Agnes winning if only one prize is drawn? (Each ticket has the same chance of winning.)

The probability of winning:

2 points

7. One of the legs of a right-angled triangle is 3 cm long, the angle opposite to it is 18.5° . How long is the other leg of the triangle? Make a sketch and justify your answer with calculations.

2 points

The length of the other leg:

1 point

8. The first term of a geometric progression is 8, its common ratio is $\frac{1}{2}$. Calculate the fifth term of the progression.

The fifth term of the progression:

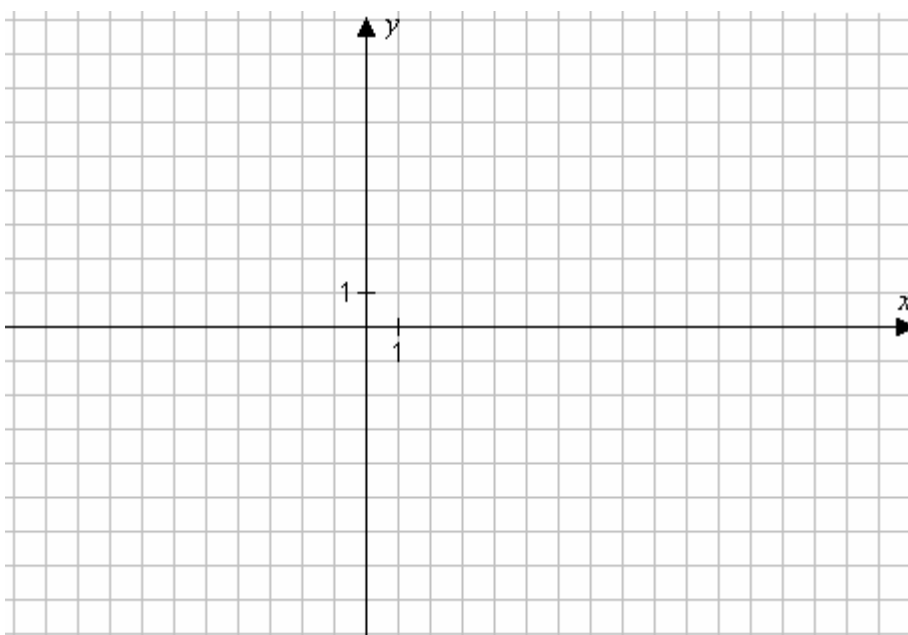
2 points

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9. There are 4 vertices in a graph. The numbers of edges leading from the individual vertices are 3; 2; 2; 1. How many edges does the graph have?

The number of edges of the graph:	2 points	
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10. Graph the function $f(x) = \frac{1}{2}x - 4$ on the interval $[-2; 10]$.



2 points	
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11. Five out of the 22 students of a class are put in the first group for the oral Final Examinations.

- a) In how many different ways is it possible to select the students for the first group randomly?

The examinations start by each of them giving their history presentation.

- b) In how many orders can the 5 selected students give their history presentations?

a)	2 points	
b)	2 points	

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12. The inner radius of a spherical ball is 13 cm. How many litres of air does this ball contain? Explain your answer.

The ball contains litres of air.	2 points	
	1 point	

End of Paper I.

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		maximum score	score attained
Paper I.	Problem 1.	2	
	Problem 2.	2	
	Problem 3.	3	
	Problem 4.	3	
	Problem 5.	2	
	Problem 6.	2	
	Problem 7.	3	
	Problem 8.	2	
	Problem 9.	2	
	Problem 10.	2	
	Problem 11.	4	
	Problem 12.	3	
TOTAL		30	

teacher

	score attained (elért pontszám)	score input for program (programba beírt pontszám)
Paper I (I. rész)		

teacher
(javító tanár)

registrar
(jegyző)

Note:

1. Leave this table blank, and do not sign here if the candidate has started working on Paper II.
2. If the examination was interrupted during the candidate working on Paper I, or it was not continued with Paper II, fill out this table and sign.

(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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II.

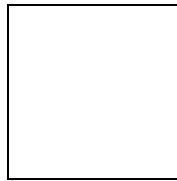
Időtartam: 135 perc
Time allowed: 135 minutes

Pótlapok száma / Number of extra sheets	
Tisztázati / Final version	
Piszkozati / Draft	

**OKTATÁSI MINISZTERIUM
MINISTRY OF EDUCATION**

Instructions to candidates

- The time allowed for this examination paper is 135 minutes. When that time is over, you will have to stop working.
- You may solve the problems in any order.
- In part **B**, you are only required to solve two out of the three problems. **When you have finished the examination paper, write in the square below the number of the problem NOT selected.** *If it is not clear* for the teacher marking the paper which problem you do not want to be assessed, then problem 18 will not be assessed.



- In solving the problems, you are allowed to use a calculator that cannot store and display verbal information. You are also allowed to use four-digit data tables. The use of any other electronic devices or printed material is forbidden!
- Always write down the reasoning used in obtaining the answers, since a large part of the attainable points will be awarded for that.
- Make sure that the calculations of intermediate results are also possible to follow.
- In solving the problems, theorems studied and given a name in class (e.g. the Pythagorean theorem or the altitude theorem) do not need to be stated precisely. It is enough to refer to them by the name, *but their applicability needs to be briefly explained.*
- Always state the final result (the answer to the question of the problem) in words, too!
- Write in pen. Diagrams are also allowed to be drawn in pencil. If you cancel any solution or part of a solution by crossing it over, it will not be assessed.
- Only one solution to each problem will be assessed.
- Please do not write anything in the grey rectangles.

A

13. Solve the following equation on the set of real numbers.

$$\cos^2 x + 4 \cos x = 3 \sin^2 x.$$

12 points	
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- 14.** The second term of an arithmetic progression is 17, and the third term is 21.
a) Find the sum of the first 150 terms.

We have calculated the sum of the first 111 terms in this sequence, it is 25 863.

- b) Is it true that in whatever order the digits of 25 863 are written down, the number obtained will always be divisible by three? (Explain your answer.)
- c) Gábor wrote down the digits of 25 863 in a certain order and obtained a number divisible by four. What may be the digit in the tenths' place? (Explain your answer.)

a)	5 points	
b)	3 points	
c)	4 points	

15. The maximum score attainable on a test was 100 points. The table below shows the scores of 15 students:

Score attained	100	95	91	80	65	31	17	8	5
Number of students	3	2	1	2	1	2	2	1	1

a) Find the average (arithmetic mean), the mode and the median of all the test scores.

b) The test grades are awarded according to the following table:

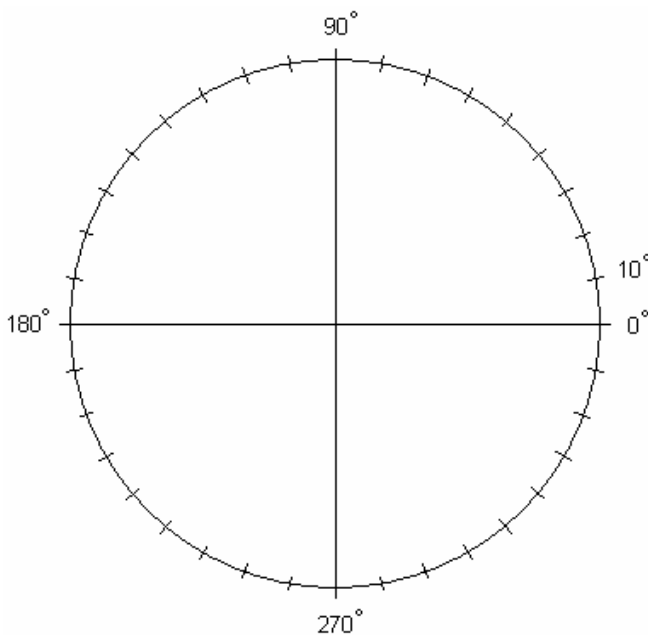
Score	Grade
80 – 100	excellent
60 – 79	good
40 – 59	satisfactory
20 – 39	pass
0 – 19	fail

Use this information to fill out the table below:

Grade	excellent	good	satisfactory	pass	fail
Number of students					

c) Draw a pie chart representing the distribution of the grades. Indicate the central angle corresponding to each sector.

a)	5 points	
b)	2 points	
c)	5 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 diameter of the base of a right circular cone is equal to its slant height. The length of the altitude of the cone is $5\sqrt{3}$ cm. Draw a sketch.
- a) Calculate the surface area of the cone.
 - b) Calculate the volume of the cone.
 - c) What is the central angle of the lateral surface of the cone if it is unfolded and laid on a plane?

a)	9 points	
b)	2 points	
c)	6 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.** Anna and Zsuzsi both wanted to buy a certain magazine at the newsstand, but neither girl had enough money. Anna's money was 12% less than the price of the magazine, and Zsuzsi was short of one fifth of the price. So they decided to buy the magazine together. After the purchase they had 714 forints left altogether.
- a) How much did the magazine cost, and how much money did each girl have (separately) before the purchase?
- b) They want to divide the remaining 714 forints between them in a fair way, that is, in proportion to the amounts that they had before buying the magazine. What will be the share received by Anna and how much will Zsuzsi get?

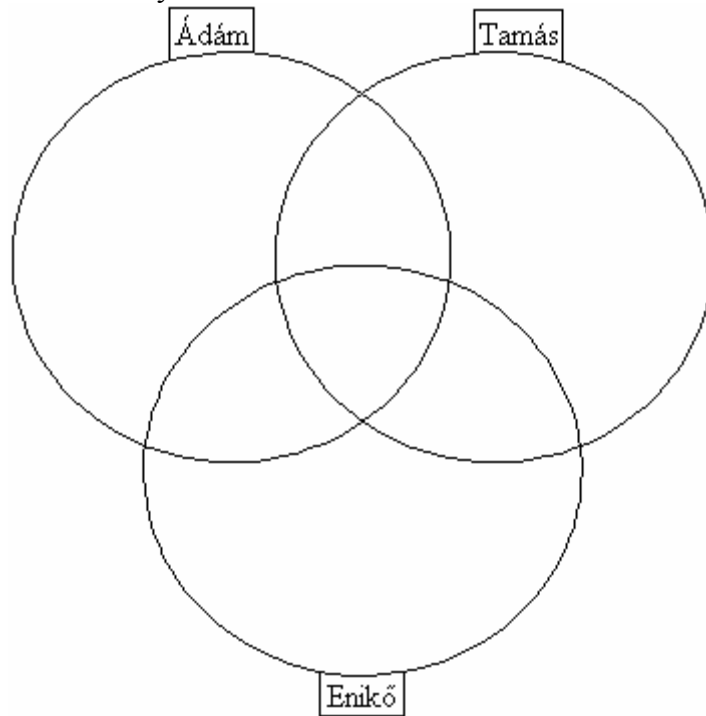
a)	10 points	
b)	7 points	

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 puzzle in a magazine showed two drawings that were almost the same, apart from 23 small differences. The task was to find those differences.
 First Ádám and Tamás examined the drawings: Ádám found 11 differences, Tamás found 15, but there were only 7 differences that each of them noticed.
a) How many differences were there that neither of them noticed?

Then Enikő also started to count differences but she did not find all of them either. There were only 4 that all three of them found. When they compared their results, it turned out that out of the differences marked by Enikő six were also found by Ádám, and nine were also found by Tamás. They were happy to see that the three of them together had found all the differences.

- b)** Use the given information to fill out the following set diagram showing the number of differences found by each of them.



- c)** Negate the following statement:
Enikő found all the differences.
- d)** What is the probability that a difference chosen at random was found by at least two of them?

a)	4 points	
b)	7 points	
c)	2 points	
d)	4 points	

	number of problem	score attained	total	maximum score
Part A	13.			12
	14.			12
	15.			12
Part B				17
				17
	← problem not selected			
TOTAL				70

	score attained	maximum score
Paper I		30
Paper II		70
GRAND TOTAL		100
Grade (percentage)		

	score attained (elért pontszám)	score input for program (programba beírt pontszám)
Paper I (I. rész)		
Paper II (II. rész)		

teacher
(javító tanár)

registrar
(jegyző)