

**ÉRETTSÉGI VIZSGA • 2006. október 25.**

**MATEMATIKA  
ANGOL NYELVEN  
MATHEMATICS**

**2006. október 25. 8:00**

**KÖZÉPSZINTŰ  
ÍRÁSBELI VIZSGA  
INTERMEDIATE LEVEL  
WRITTEN EXAM**

**I.**

Időtartam: 45 perc  
The exam is 45 minutes long

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

**OKTATÁSI ÉS KULTURÁLIS  
MINISZTERIUM  
MINISTRY OF EDUCATION  
AND CULTURE**

## Important information

1. The exam is 45 minutes long, after that you should stop working.
2. You may work on the problems in arbitrary order.
3. You may work with any calculator as long as it is not capable of storing and displaying textual information and you may also consult any type of four digit mathematical table. The use of any other kind of electronic device or written source is forbidden.
4. **The answer for a question should be entered into the corresponding frame**, the solution should be written down only if the question asks you to do so.
5. You are supposed to work in pen; diagrams, however, may also be drawn in pencil. Anything written in pencil outside the diagrams cannot be evaluated by the examiner. Any solution or some part of a solution that is crossed out will not be marked.
6. There is only one solution for every question that will be marked. If you attempt a question more than once then you should clearly indicate the one to be marked.
7. Please, leave the **rectangular shaded areas blank**.

1. List the elements of the set  $H$  if  $H = \{\text{two-digit square numbers}\}$ .

$H = \{$	$\}$	2 points	
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2. Find the coordinates of the intersection of the line  $5x - 3y = 2$  and the  $y$ -axis!

The intersection point is :	2 points	
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3. There were six classes enrolling a soccer team in the school tournament in October. How many matches will be played if any two teams will be playing against each other and the return matches will also be played?

The number of matches to be played is:	3 points	
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4. The outdoor temperature was measured on five occasions on a certain day in March. The mean of the measured data is  $1\text{ }^{\circ}\text{C}$ , and their median is  $0\text{ }^{\circ}\text{C}$ . List five possible values of temperature!

A possible data-set (in $^{\circ}\text{C}$ ) is:	4 points	
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5. Find, in a circle of unit radius, the length of the arc whose central angle is equal to  $270^{\circ}$ .

The length of the arc is:	2 points	
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6. Three-digit numbers are composed using the digits 0, 5 and 7. Write down those of them that are divisible by five and composed of different digits.

The numbers are:	2 points	
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7. The lengths of the edges, starting from a vertex of a cuboid are  $a$ ,  $a$  and  $b$ , respectively. Express, in terms of these distances, the length of the space diagonal starting from this vertex.

The length of the space diagonal is:	3 points	
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8. A 1-forint coin is flipped twice in a row and the results are recorded. There are three possible events that can happen:
- event  $A$ : two heads are recorded;
  - event  $B$ : one head and one tail is recorded;
  - event  $C$ : two tails are recorded.
- What is the probability that event  $B$  occurs?

The probability of event $B$ is:	2 points	
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9. There are 518 students altogether, attending a certain school. These students form the set  $A$ . The set  $B$  consists of the 27 students of the class 12. c of the school. What is the cardinality of the set  $A \cap B$ ?

The cardinality of $A \cap B$ is:	2 points	
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10. The lengths of the diagonals of a rhomb are 12 and 20, respectively. Calculate the scalar product of the diagonal vectors. Justify your answer!

	1 point	
The value of the scalar product is:	2 points	

**11.** Decide if the statement  $B$  below is true or false!

$B$ : *If two opposite angles of a quadrilateral are both right angles then the quadrilateral is a rectangle.*

Write down the converse of the statement ( $C$ ).

Is the statement  $C$  true or false?

The logical value of $B$ is:	1 point	
The statement $C$ is:	1 point	
The logical value of $C$ is:	1 point	

**12.** There are seven kind of fruit sold at a fruitstand in the market. Kate buys here three kind of fruit, 1 kg of each. How many ways are there for Kate to make her choice? (You should enter the result as a number).

The number of ways is:	2 points	
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		maximal score	score
Part I.	problem 1.	2	
	problem 2.	2	
	problem 3.	3	
	problem 4.	4	
	problem 5.	2	
	problem 6.	2	
	problem 7.	3	
	problem 8.	2	
	problem 9.	2	
	problem 10.	3	
	problem 11.	3	
	problem 12.	2	
<b>TOTAL</b>		<b>30</b>	

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 date

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 examiner

	Pontszáma/score	programba beírt pontszám/score written in the programme
I. rész/Part I.		

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 Dátum/date

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 javító tanár/examiner

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 Jegyző/registrar

**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!

**Remarks:**

1. If the candidate started working on Part II., this table and the signature area should be left blank.
2. If the examination is stopped while the candidate is working on Part I. or it is not continued with Part II, this table and the signature area should be completed.



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WRITTEN EXAM**

**II.**

Időtartam: 135 perc  
The exam is 135 minutes long

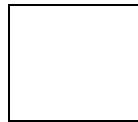
Pótlapok száma/ Number of extra sheets	
Tisztázati/Final essays	
Piszkozati/Drafts	

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## Important information

1. The exam is 135 minutes long, after that you should stop working.
2. You may attempt the questions in arbitrary order.
3. You are supposed to answer two out of the three questions in part **B**. **Please remember to enter the number of the question you have not attempted into the empty square below before finishing your paper.** Should there *arise any ambiguity* for the examiner as for which question should not be marked, it is question no. 18 that will not going to be assessed.



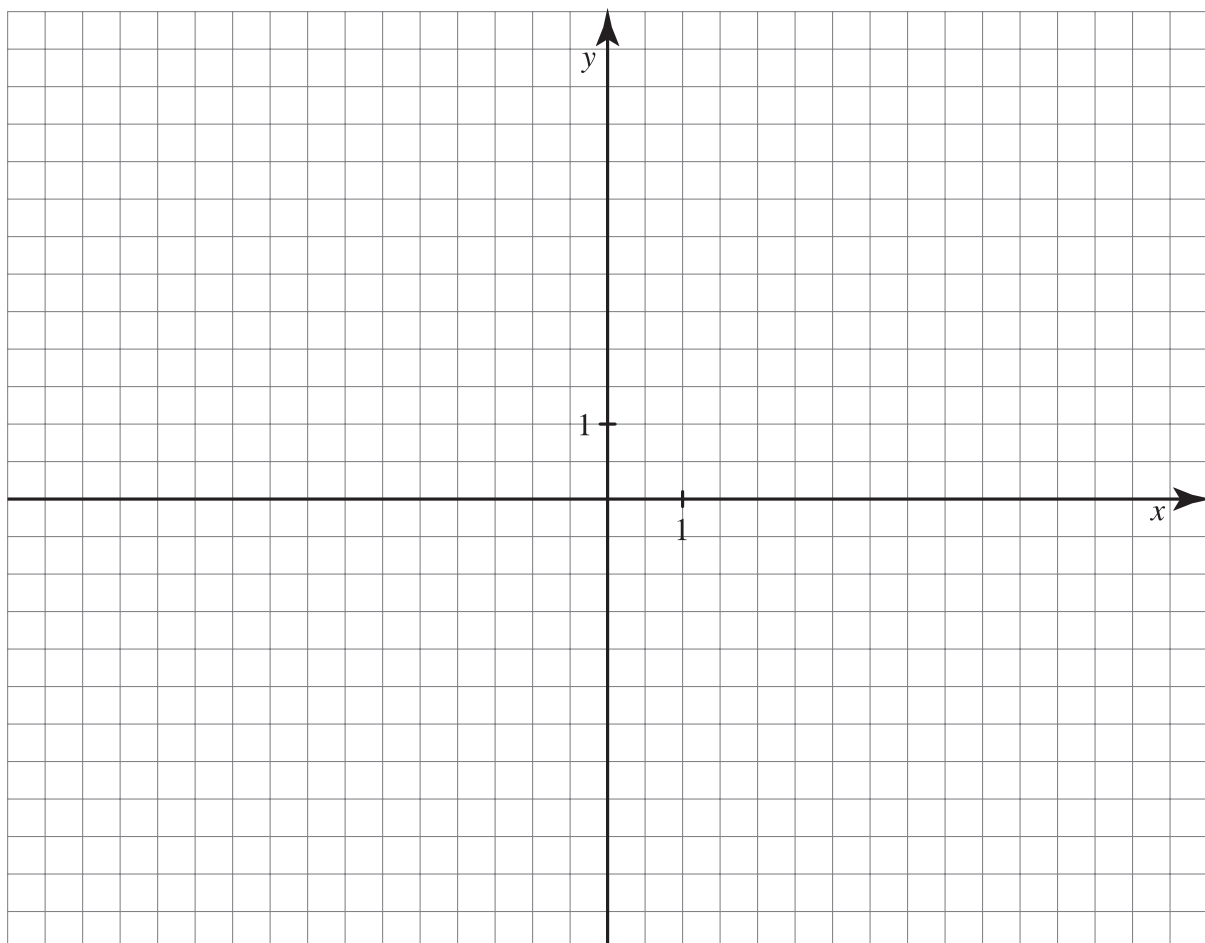
4. You may work with any calculator as long as it is not capable of storing and displaying textual information and you may also consult any type of four digit mathematical table. The use of any other kind of electronic device or written source is forbidden.
5. **Remember to show your reasoning, because a major part of the score is given for this component of your work.**
6. **Remember to show your working, including substantial calculations.**
7. When you refer to a theorem that has been covered at school and has a common name (e.g. Pithagoras' theorem, sine rule, etc.) you are not expected be state it meticulously; it is usually sufficient to put the name of the theorem. *However, you should briefly explain, why and how it can be applied.*
8. Remember to answer each question (i.e. communicating the result) also in textual form.
9. You are supposed to work in pen; diagrams, however, may also be drawn in pencil. Anything written in pencil outside the diagrams cannot be evaluated by the examiner. Any solution or some part of a solution that is crossed out will not be marked.
10. There is only one solution will be marked for every question. If you attempt a question more than once then you should **clearly indicate** the one to be marked.
11. Please, **do not write anything in the shaded rectangular areas.**

**A**

**13.**

- a) Sketch the diagram of the function whose domain is  $[-2; 4]$  and is defined by the mapping  $x \rightarrow (x - 1,5)^2 + 0,75$ .
- b) Find the minimum value of the above function and also the value where this minimum is attained.
- c) Solve the equation  $\sqrt{x^2 - 3x + 3} = 1 - 2x$  on the set of real numbers.

<b>a)</b>	2 points	
<b>b)</b>	2 points	
<b>c)</b>	8 points	
<b>T.:</b>	12 points	





- 14.** There were eight students competing in the final round of a competition. They were given three problems to be solved. The maximum score for the first problem was 40 points, that for the second one was 50 points, and for the third one it was 60 points. The following table contains the scores of the contestants for each problem, respectively.

No. of contestant	I.	II.	III.	Total score	Achievement in percentage
1.	28	16	40		
2.	31	35	44		
3.	32	28	56		
4.	40	42	49		
5.	35	48	52		
6.	12	30	28		
7.	29	32	45		
8.	40	48	41		

- a)** Complete the table. The achievement percentages should be rounded to the nearest integer.  
Which contestant has won the competition, who was the second and the third?
- b)** One paper is selected randomly from those written by the eight contestants. What is the probability that its percentage score exceeds 75% ?
- c)** Another student, being ill, could not participate in the finals. She got the paper the day after and solved the problems. Comparing her achievement to that of the eight contestants she found that her score for the first problem was equal to the median score of the contestants for the first problem (rounded to the nearest integer); her score for the second question was equal to the arithmetic mean of the scores of the eight contestants for the second question (also rounded to the nearest integer); finally, she got 90% of the scores for the third problem. What was the total score of this student. How would she have been ranked in the contest, based on her achievement?

<b>a)</b>	5 points	
<b>b)</b>	2 points	
<b>c)</b>	5 points	
<b>T.:</b>	12 points	



- 15.** There are three kind of trees (pines, oaks and planes) grown in three rectangular plots in a forestry. There are 4 less rows in the plot of the oak-trees than in the plot of the pine-trees and there are 5 less trees in each oak-row than the number of trees in a row of the plot of the pine-trees. The total number of oak trees is 360 less than that of the pine-trees. When planting the plane-trees, the number of rows was increased by 3 and the number of trees per row was increased by 2, both with respect to the pine-trees. Hence there were planted 228 more plane-trees than pine-trees.
- a)** How many rows are there in the plot of the pine-trees? How many pine-trees are there in a row?
- b)** How many plane-trees were planted altogether?

<b>a)</b>	10 points	
<b>b)</b>	2 points	
<b>T.:</b>	12 points	





**B**

**You are supposed to answer any two out of the questions no. 16-18. The number of the question not attempted should be entered into the empty square on sheet no. 3.**

- 16.** A road construction company is starting a new project. The road they are asphaltting on the first day is 220 m long. The next day they complete 230 meters, the day after 240 meters and so on: increasing daily the number of workers they manage to complete 10 meters more each day.
- a) How many meters can they asphalt on the 11th working day?
  - b) The total length of road to be asphalted in this project is 7.1 km. How many working days are necessary to finish the project?
  - c) How many meters of road is asphalted on the last working day?
  - d) There were twice as many workers employed on the 21st working day than on the first day. Can one support the assumption that the length of road asphalted on any particular day is directly proportional to the number of workers on that day? (Justify your answer!)

a)	3 points	
b)	8 points	
c)	3 points	
d)	3 points	
<b>T.:</b>	<b>17 points</b>	



**You are supposed to answer any two out of the questions no. 16-18. The number of the question not attempted should be entered into the empty square on sheet no. 3.**

- 17.** One of the sides of a triangle is 6 cm long. The angles lying on this side are  $50^\circ$  and  $60^\circ$ , respectively. The centre of the inscribed circle of the triangle is reflected through the sides, respectively. These three mirror images, together with the vertices of the triangle, form a convex hexagon.
- Find the angles of this hexagon.
  - Compute the lengths of those two sides of the hexagon, that are meeting at the  $60^\circ$  vertex of the triangle.
  - What is the area of the hexagon in  $\text{cm}^2$ ?

The answers for questions **b)** and **c)** should be given correct to the nearest tenth of a centimeter.

<b>a)</b>	6 points	
<b>b)</b>	5 points	
<b>c)</b>	6 points	
<b>T:</b>	17 points	



**You are supposed to answer any two out of the questions no. 16-18. The number of the question not attempted should be entered into the empty square on sheet no. 3.**

- 18.** When comparing statistical information obtained from various countries, social scientists are using the following empirical formula:  $E = 75,5 - 5 \cdot 10^{\frac{6000-G}{6090}}$ . In the formula  $E$  is the mean life expectancy in years at the time of birth,  $G$  is the gross domestic product (GDP) expressed in terms of the value of the US dollar in 1980.
- What was the life expectancy in a certain country in 2005 if  $G$  was 1090 dollars in that year?
  - By how much may the life expectancy change in this country by 2020 if prognostics forecast that the value of  $G$  will increase to the triple of its value at 2005?
  - In another country the mean life expectancy was 68 years in 2005. How much was the GDP ( $G$ ) in this country (expressed in terms of the 1980 US dollar)?

<b>a)</b>	4 points	
<b>b)</b>	5 points	
<b>c)</b>	8 points	
<b>T.:</b>	17 points	



	No. of the question	Score	total	maximal score
part II./A	13.			12
	14.			12
	15.			12
part II./B				17
				17
	← problem not chosen			
<b>TOTAL</b>				<b>70</b>

	Score	maximal score
Part I.		30
Part II.		70
<b>TOTAL</b>		<b>100</b>

\_\_\_\_\_

date

\_\_\_\_\_

examiner

	elért pontszám/score	programba beírt pontszám/Score entered in the programme
I.rész/Part I.		
II. rész /Part II.		

\_\_\_\_\_

Dátum/date

\_\_\_\_\_

javító tanár/examiner

\_\_\_\_\_

Jegyző/registrar