

**ÉRETTSÉGI VIZSGA • 2011. május 3.**

**MATEMATIKA  
ANGOL NYELVEN**

**KÖZÉPSZINTŰ  
ÍRÁSBELI VIZSGA**

**2011. május 3. 8:00**

**I.**

Időtartam: 45 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

**NEMZETI ERŐFORRÁS  
MINISZTERIUM**

## Important information

1. The exam is 45 minutes long, after that you should stop working.
2. You may proceed to solve the problems in arbitrary order.
3. You may work with any kind of 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. **You should enter the result in the shaded area** provided for this in the examination paper. You are supposed to show your reasoning only when the text of the problem instructs you to do so.
5. You are supposed to work in pen; diagrams can still be drawn in pencil. Anything outside the diagram and written in pencil cannot be marked by the examiner. If a solution or some part of a solution is crossed out then it is not going to be marked.
6. There is only one solution to be marked in case of each problem. If you attempt a question more than once the you should clearly indicate the part you want to be marked.
7. Please, do not write anything in the **shaded rectangular areas**.

1. Factorise the following expression.

$$a^3 + a$$

The factor form is	2 points	
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2. 9000 forints have been spent in August on school requisites by a family for their offspring who would be in ninth grade. The respective costs of textbooks, notebooks and accessories are in the proportion 14:5:1. How much money was spent on textbooks and notebooks, respectively, out of the total amount of 9000?

The textbooks cost: .....Ft.	2 points	
The notebooks cost: .....Ft.		

3. The table below shows the number of T-shirts sold in a big fashion house. The figures are grouped according to the respective sizes.

Size (of the T-shirt)	Items sold
XS	60
S	125
M	238
L	322
XL	198
XXL	173

- a) What is the relative frequency of the T-shirts of size M sold in this fashion house?
- b) What is the mode of the sizes in this sample?
- c) Assume that the total number of sold items is the same, furthermore, that equal number of T-shirts of each size would be sold, how many T-shirts of each size are to be sold?

a) The relative frequency is	1 point	
b) The mode is	1 point	
c)	1 point	

4. There are three assertions about the centre  $O$  of the circumcircle of a general triangle.
- A) The point  $O$  is the intersection of the perpendicular bisectors of the respective sides.
  - B) The distances of the point  $O$  from the respective sides are equal in every triangle.
  - C) The distances of the point  $O$  from the respective vertices are equal in every triangle.

Enter the code(s) of the true one(s) among these three assertions in the answer field.

The code(s) of the true assertion(s):	2 points	
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5. Solve the following simultaneous system of equations on the set of real numbers.

$$\left. \begin{array}{l} x + 4y = 48 \\ 2x + 4y = 60 \end{array} \right\}$$

$x =$ $y =$	2 points	
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6. Each member of a group of six shook hands with exactly three members of the group. How many handshakes took place altogether?

The number of handshakes is	2 points	
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7. Let  $X = 6 \cdot 10^{40}$  and  $Y = 4 \cdot 10^{61}$ . Write down the product  $X \cdot Y$  in scientific notation.

$X \cdot Y =$	2 points	
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8. In the geometric progression  $(a_n)$  it is given that  $a_2 = 8$  and  $a_3 = 6$ . Calculate the fifth term of this progression. Justify your answer.

	2 points	
$a_5 =$	1 point	

9. Observation confirms that when both the height ( $h$ ) of an adult man and the length ( $f$ ) of his forearm are measured in centimeters then the relation  $h = \frac{10f + 256}{3}$  holds. Find the length of the forearm of a man who is 182 cm tall, based on this experimental law. Justify your answer.

	2 points	
The forearm of this man is    cm long.	1 point	

- 10.** A rare book's price was 23 000 Ft two years ago according to the catalog. After one year the price has increased by 20%. In the second year the price has increased by 30%. What is the price of the book after these two years? By how many percent did the price increase after these two years, altogether?  
Justify your answer.

	1 point	
The price of the book after two years is:	1 point	
The increment of the price is .....%.	1 point	

- 11.** Find those real numbers  $b$  for which  $\sqrt{b^2} = -b$ .

The possible values of $b$ are	2 points	
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- 12.** Consider the following two sets:  $A = \{\text{the positive divisors of } 36\}$ ;  $B = \{\text{those divisors of } 16 \text{ that are square numbers}\}$ .  
By listing their elements, respectively, determine the sets  $A$ ;  $B$ ;  $A \cap B$ ;  $A \setminus B$ .

$A = \{ \quad \quad \quad \}$	1 point	
$B = \{ \quad \quad \quad \}$	1 point	
$A \cap B = \{ \quad \quad \quad \}$	1 point	
$A \setminus B = \{ \quad \quad \quad \}$	1 point	

		maximal score	score attained
Paper I.	problem 1.	2	
	problem 2.	2	
	problem 3.	3	
	problem 4.	2	
	problem 5.	2	
	problem 6.	2	
	problem 7.	2	
	problem 8.	3	
	problem 9.	3	
	problem 10.	3	
	problem 11.	2	
	problem 12.	4	
<b>TOTAL</b>		<b>30</b>	

\_\_\_\_\_ date

\_\_\_\_\_ teacher

	score rounded to the <b>next integer</b> (pontszám <b>egész számra</b> kerekítve)	<b>integer</b> score input for program (programba beírt <b>egész</b> pontszám)
Paper I. (I. rész)		

\_\_\_\_\_ teacher (javító tanár)

\_\_\_\_\_ registrar (jegyző)

\_\_\_\_\_ date (dátum)

\_\_\_\_\_ date (dátum)

Note:

1. Leave this table blank, and do not sign it 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 then complete this table and sign it.

(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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**2011. május 3. 8:00**

**II.**

Időtartam: 135 perc

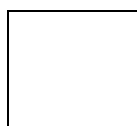
Pótlapok száma	
Tisztázati	
Piszkozati	

**NEMZETI ERŐFORRÁS  
MINISZTERIUM**



## Important information

1. The exam is 135 minutes long, after that you should stop working.
2. You may proceed to solve the problems in arbitrary order.
3. In section **B** you are required to solve only two out of the three problems. **Please, remember, upon finishing your paper, to enter the number of the question you have not attempted into the empty square below.** Should there arise any ambiguity for the examiner about the question you ask not to be marked, it is question no. 18. that will not going to be assessed.



4. You may work with any kind of 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 when writing down the solutions; a major part of the score is given for this component of your work**
6. **Remember to include the substantial calculations in a clear manner.**
7. When referring to a theorem having a common name (e. g. Pythagoras' Theorem, sine rule) that you have done at school you are not expected to state it meticulously: it is usually sufficient to put the theorem's name. However, you are supposed to state clearly why and how does it apply.
8. Remember to answer each question (e. g. providing the result) also in text form.
9. You are supposed to work in pen; diagrams can still be drawn in pencil. Anything outside the diagram and written in pencil cannot be marked by the examiner. If a solution or some part of a solution is crossed out then it is not going to be marked.
10. There is only one solution of each problem to be marked. If you attempt a question more than once then you **should clearly indicate** the part you want to be marked.
11. Please, do not write anything in the **shaded rectangular areas**.

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**A**

**13.** Solve the following equations on the set of real numbers.

**a)**  $x^2 - (x-1)^2 = 2.$

**b)**  $\lg x - \lg(x-1) = 2.$

<b>a)</b>	6 points	
<b>b)</b>	6 points	
<b>T.:</b>	12 points	



14. There are no equal digits in Susie's seven digit phone number. It is also given that its first digit is different from zero. Maggie noticed that the keys actually used when calling Susie are located only in two columns out of the three columns the keys are arranged on her mobile. What's more, the first few keys to be pressed in some order are all in the same column and the remaining keys to be pressed in some order are all in another column. How many phone numbers of this kind do exist altogether?



<b>T.:</b>	12 points	
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**15.**

- a)** Investigate the following functions and their extrema. Enter the name of the respective functions in the corresponding fields of the table below (In this item you are not expected to justify your answer.)

$$f : \mathbf{R} \rightarrow \mathbf{R}, x \mapsto \sin x + 2;$$

$$g : \mathbf{R} \rightarrow \mathbf{R}, x \mapsto -|x|;$$

$$h : \mathbf{R} \setminus \{0\} \rightarrow \mathbf{R}, x \mapsto \frac{3}{x};$$

$$j : [0; +\infty[ \rightarrow \mathbf{R}, x \mapsto \sqrt{x};$$

$$m : \mathbf{R} \rightarrow \mathbf{R}, x \mapsto 2^x.$$

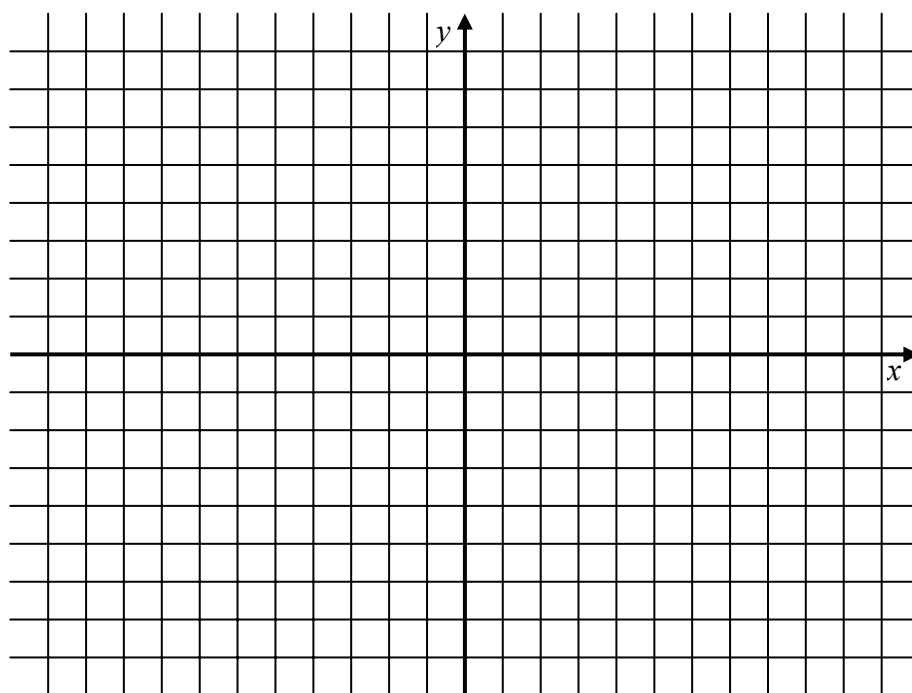
the function has maximal value only	the function has minimal value only	the function has both maximal and minimal values	the function has no extremal values

- b)** The domain of the function  $k$  is the closed interval  $[0; 4]$  and  $k(x) = x^2 - 6x + 5$ .

- b1)** Sketch the graph of the function in the provided coordinate system.  
**b2)** Determine the range of the function. (You are not expected to justify your answer for this question.)  
**b3)** Determine the zeros of the function.

<b>a)</b>	5 points	
<b>b1)</b>	3 points	
<b>b2)</b>	2 points	
<b>b3)</b>	2 points	
<b>T.:</b>	12 points	

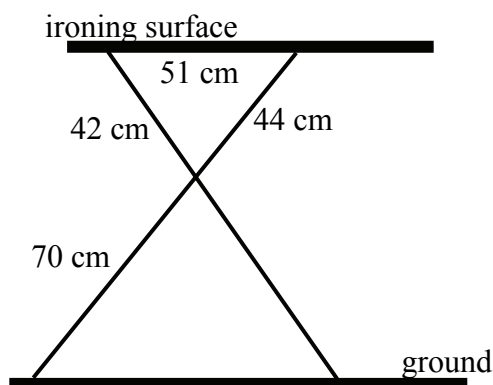




**B**

**You are expected to solve any two out of the problems 16-18. Write the number of the problem not selected in the blank square on page 3.**

- 16.** The diagram shows the dimensions of the supporting structure of an ironing board. The board itself is parallel to the ground. One of the bearer bars is 114 cm long.
- a) Find the length in centimeters of the other bearer bar.
  - b) Find the height of the ironing surface above the ground if it is given that the ironing board is 3 cm thick.



<b>a)</b>	7 points	
<b>b)</b>	10 points	
<b>T.:</b>	17 points	



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**You are expected to solve any two out of the problems 16-18. Write the number of the problem not selected in the blank square on page 3.**

**17.** In each round of a game the players roll a fair die three times in a row.

Having done so the player wins in this round if either

1. each of the three scores are even: the gain is then 300 tokens; or
2. the first score is 1 and exactly one of the next two scores is even: the gain is then 500 tokens; or
3. the first score is 3 and both of the other two scores are odd: the gain is then 800 tokens; or
4. each score is equal to 5: the gain is then 2000 tokens.

**a)** What is the probability that in a given round a certain player wins

- a1)** 300 tokens;
- a2)** 500 tokens;
- a3)** 800 tokens;
- a4)** 2000 tokens.

**b)** What is the probability that a player does not win anything in a certain round?

<b>a)</b>	11 points	
<b>b)</b>	6 points	
<b>T.:</b>	17 points	

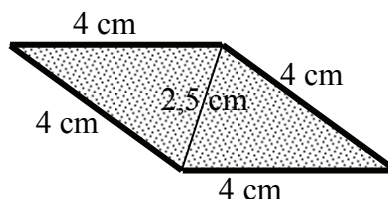


**You are expected to solve any two out of the problems 16-18. Write the number of the problem not selected in the blank square on page 3.**

- 18.** There are 16 girls and 18 boys in a certain class. They organized a party and the girls baked cookies for the boys. Each of the girls baked the same number of cookies and it turned out that each boy received the same and equal number of cookies. It is also given that the total number of cookies was greater than 400 but smaller than 500.

a) How many cookies did the girls bake altogether?

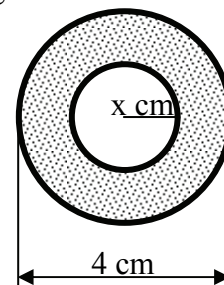
Dani got his share from Brigitta's lot of cookies only. The shape of these cookies was that of a rhomb whose dimensions are shown on the diagram to the right. He tried to arrange as many of them on a round plate as possible, with their acute angled vertex at the centre of the plate. While trying he did not put cookies on their edges, neither did he pile them on top of each other.



b) At most how many cookies would fit on the plate in this arrangement?

Andrea used a circular ring-shaped biscuit cutter to shape her cookies. The rhomb shaped cookies and the ring shaped ones had the same area from top down.

c) Find the inner radius of the ring shaped cookies in cm.



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



	number of the problem	maximal score	score attained	total
Part II./A	13.	12		
	14.	12		
	15.	12		
Part II./B		17		
		17		
			← problem not selected	
<b>TOTAL</b>		<b>70</b>		

	maximal score	score attained
Part I.	30	
Part II.	70	
<b>Score on the written examination</b>	<b>100</b>	

\_\_\_\_\_

date

\_\_\_\_\_

teacher

	score rounded to the <b>next integer</b> (pontszám <b>egész számra</b> kerekítve)	<b>integer</b> score input for program (programba beírt <b>egész</b> pontszám)
Part I. (I. rész)		
Part II. (II. rész)		

\_\_\_\_\_

teacher (javító tanár)

\_\_\_\_\_

registrar (jegyző)

\_\_\_\_\_

date (dátum)

\_\_\_\_\_

date (dátum)