

**ÉRETTSÉGI VIZSGA • 2011. október 18.**

**MATEMATIKA  
ANGOL NYELVEN**

**KÖZÉPSZINTŰ  
ÍRÁSBELI VIZSGA**

**2011. október 18. 8:00**

**I.**

Időtartam: 45 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

**NEMZETI ERŐFORRÁS  
MINISZTERIUM**

## Instructions to candidates

1. The time allowed for this examination paper is 45 minutes. When that time is over, you will have to stop working.
2. You may solve the problems in any order.
3. In solving the problems, you are allowed to use a calculator that cannot store and display verbal information. You are also allowed to use any book of four-digit data tables. The use of any other electronic device, or printed or written material is forbidden.
4. **Write the final answers in the appropriate frames.** You are only required to write down details of the solutions if you are instructed by the problem to do so.
5. Write in pen. The examiner is instructed not to mark anything in pencil, other than diagrams. 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.
6. Only one solution to each problem will be assessed. In the case of more than one attempt to solve a problem, indicate clearly which attempt you wish to be marked.
7. **Do not write anything in the grey rectangles.**

1. Express 420 as a product of prime numbers.

420 =	2 points	
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2. Divide 36 000 into two parts that are in a 5 : 4 ratio.

The parts are:	2 points	
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3. In a cell culture, the number of cells takes 2 days to double. At the beginning of the first day, the culture consists of 5000 cells. How many cells will be there when 8 days have elapsed?  
Write down your calculations in detail.

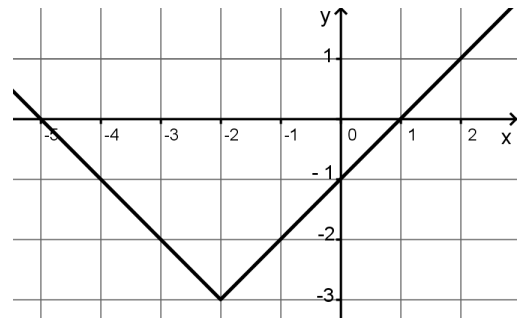
	2 points	
The number of cells:	1 point	

4. Let  $\mathbf{N}$  denote the set of natural numbers, let  $\mathbf{Z}$  denote the set of whole numbers and let  $\emptyset$  denote the empty set. Write down the results of the following set operations:

- a)  $\mathbf{N} \cap \mathbf{Z}$ ;
- b)  $\mathbf{Z} \cup \emptyset$ ;
- c)  $\emptyset \setminus \mathbf{N}$ .

$\mathbf{N} \cap \mathbf{Z} =$	1 point	
$\mathbf{Z} \cup \emptyset =$	1 point	
$\emptyset \setminus \mathbf{N} =$	1 point	

5. The diagram shows a part of the graph of the function  $f(x) = |x + a| + b$  defined on the set of real numbers. Find the values of  $a$  and  $b$ .



$a =$ , $b =$	2 points	
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6. What is the median of the numbers 2; 11; 7; 3; 17; 5; 13 ?

The median is                      .	2 points	
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7. Draw a simple graph on 4 points in which the degrees of the points are 3, 2, 2, 1.

Answer:		
	2 points	

8. The fiftieth term of an arithmetic progression is 29, and the fifty-first term is 26. Calculate the first term.

	2 points	
$a_1 =$	1 point	

9. Which of the following equalities is an identity if  $a \neq 1$ ?

A)  $\frac{a^2 - a}{a - 1} = a - 1$ ;

B)  $\frac{a^2 - a}{a - 1} = a$ ;

C)  $\frac{a^2 - a}{a - 1} = a + 1$ ;

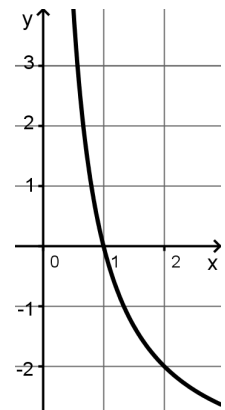
D)  $\frac{a^2 - a}{a - 1} = 0$ .

The symbol of the identity:	2 points	
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10. István wanted to sketch the graph of the function  $x \mapsto \log_{\frac{1}{2}} x$  ( $x > 0$ ) but he did not succeed, he made several mistakes.

His wrong sketch is shown in the accompanying diagram.  
Which of the statements listed below is true?

- A) It is a mistake that the function in István's sketch is strictly decreasing.
- B) It is a mistake that the function in István's sketch assigns a value of  $-2$  to  $2$ .
- C) It is a mistake that the function in István's sketch has its zero at  $1$ .

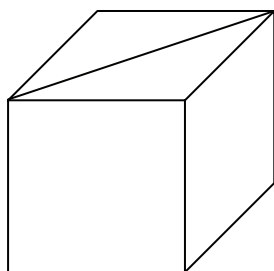


The symbol of the true statement:	2 points	
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- 11.** 2000 euros are deposited in a savings account that pays an annual compound interest at the rate of 6%. In how many whole years would it reach a value of 4024 euros? Write down your solution in detail.

	3 points	
In ..... whole years.	1 point	

- 12.** We have drawn one of the face diagonals of the cube in the figure below. In the same figure, draw another face diagonal that has an endpoint in common with the given diagonal.  
 Determine, in degrees, the angle enclosed by the two face diagonals.  
 Explain your answer.



	2 points	
The angle in question is            °.	1 point	

		maximum score	points awarded
Part I	Question 1.	2	
	Question 2.	2	
	Question 3.	3	
	Question 4.	3	
	Question 5.	2	
	Question 6.	2	
	Question 7.	2	
	Question 8.	3	
	Question 9.	2	
	Question 10.	2	
	Question 11.	4	
	Question 12.	3	
<b>TOTAL</b>		<b>30</b>	

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 date

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 examiner

	score rounded to <b>integer</b> / elért pontszám <b>egész számra</b> kerekítve	<b>integer</b> score entered in program / programba beírt <b>egész</b> pontszám
Part I / I. rész		

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 examiner / javító tanár

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 registrar / jegyző

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 date / dátum

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 date / dátum

## Remarks.

1. If the candidate has started working on Part II of the written examination, then this table and the signature section remain blank.
2. Fill out the table and signature section if the examination is interrupted during Part I or it does not continue with Part II.

## (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!



**MATEMATIKA  
ANGOL NYELVEN**

**KÖZÉPSZINTŰ  
ÍRÁSBELI VIZSGA**

**2011. október 18. 8:00**

**II.**

Időtartam: 135 perc

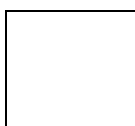
Pótlapok száma	
Tisztázati	
Piszkozati	

**NEMZETI ERŐFORRÁS  
MINISZTERIUM**



## Instructions to candidates

1. The time allowed for this examination paper is 135 minutes. When that time is over, 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 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* to the examiner which problem you do not want to be assessed, then problem 18 will not be assessed.



4. In solving the problems, you are allowed to use a calculator that cannot store and display verbal information. You are also allowed to use any book of 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 obtaining the answers since a large part of the attainable points will be awarded for that.**
6. **Make sure that the calculations of intermediate results are also possible to follow.**
7. 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.*
8. Always state the final result (the answer to the question of the problem) in words, too.
9. Write in pen. The examiner is instructed not to mark anything in pencil, other than diagrams. 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.
10. Only one solution to each problem will be assessed. In the case of more than one attempt to solve a problem, **indicate clearly** which attempt you wish to be marked.
11. **Do not write anything in the grey rectangles.**

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

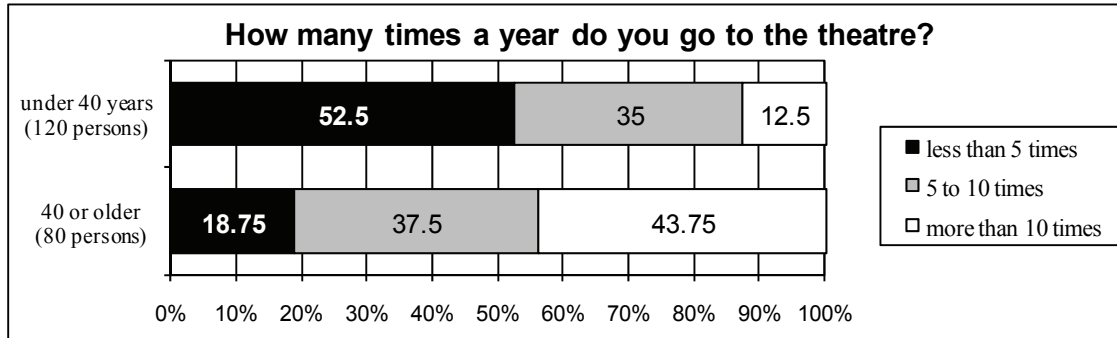
**a)**  $5 - x = \sqrt{2x^2 - 71}$

**b)**  $\sin^2 x = 1 + 2 \cos x$

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



- 14.** In a survey, a total of 200 persons in two age groups were asked how many times a year they went to the theatre. 120 of them were younger than 40 years, and 80 of them were 40 years old or older. The diagram below represents the results (expressed as percentages).



- How many people at least 40 years old answered that they went to the theatre less than 5 times?
- What percentage of the participants of the survey go to the theatre at least 5 but at most 10 times a year?
- Two people are selected at random out of the 200 participants. What is the probability that at most one of them is younger than 40 years? Round your answer to three decimal places.

a)	3 points	
b)	4 points	
c)	5 points	
<b>T.:</b>	12 points	



**15.** Given the two lines  $e: 5x - 2y = -14.5$  and  $f: 2x + 5y = 14.5$ ,

- a) determine the coordinates of their point of intersection P.
- b) prove that the lines  $e$  and  $f$  are perpendicular to each other.
- c) calculate the angle enclosed by the line  $e$  and the  $x$ -axis.

<b>a)</b>	4 points	
<b>b)</b>	4 points	
<b>c)</b>	4 points	
<b>T.:</b>	12 points	







**B**

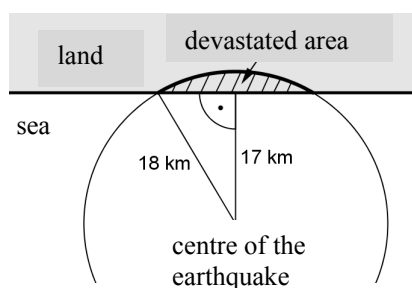
**You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 3.**

- 16.** A newspaper reported, “*The earthquake that occurred on 26 December, 2004 near Sumatra Island was measured by seismologists to have magnitude 9.3 on the Richter scale. The tsunami generated by the earthquake claimed nearly 300 thousand victims.*”

The strength of an earthquake is characterised by a number  $M$  called its magnitude on the Richter scale (non-negative for quakes that can be felt). The relationship between the Richter magnitude  $M$  of an earthquake and the amount of energy  $E$  (in joules) released at the centre of the quake is as follows:

$$M = -4.42 + \frac{2}{3} \log_{10} E .$$

- a)** The energy released in the explosion of the nuclear bomb dropped on Nagasaki in 1945 was  $1.33 \cdot 10^{14}$  joules. What is the Richter magnitude of an earthquake that releases the same amount of energy at its centre?
- b)** How much energy was released in the Sumatra earthquake on 26 December, 2004?
- c)** The Richter magnitude of the great earthquake in Chile, 2007 was greater by 2 than that of the earthquake that occurred in Canada in the same year. By what factor did the Chile quake release more energy than the Canada quake?
- d)** On an island in the ocean, the tsunami generated by the earthquake devastated an area shaped like a circular segment. The centre of the bounding arc of the circular segment is the epicentre of the earthquake, and the radius of the arc is 18 km. The centre was 17 km off the shore (see top view in the diagram). Calculate the size of the devastated area to the nearest whole square kilometre.



<b>a)</b>	3 points	
<b>b)</b>	3 points	
<b>c)</b>	5 points	
<b>d)</b>	6 points	
<b>T.:</b>	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 3.**

**17.**

- a) How many four-digit numbers of four different digits can be made, such that each digit is an element of the set  $\{1; 2; 3; 4; 5; 6; 7\}$  ?
- b) How many seven-digit numbers divisible by four can be made out of digits of 1, 2, 3, 4, 5?
- c) How many six-digit numbers divisible by three are there that only contain digits of 1, 2, 3, 4, 5, such that each of these digits occurs at least once?

<b>a)</b>	3 points	
<b>b)</b>	6 points	
<b>c)</b>	8 points	
<b>T.:</b>	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 3.**

- 18.** A sour cream tub has the shape of a truncated cone. Its dimensions are as follows: base diameter is 6 cm, top diameter is 11 cm, slant height is 8.5 cm.
- a)** In the factory, the tub is standing on its smaller circular face when it is filled with sour cream up to 86% of its height. How many cubic centimetres of sour cream does the tub contain?  
Round your answer to the nearest ten  $\text{cm}^3$ .
- b)** In the manufacturing process, 3% of the tubs become defective. Out of all the tubs manufactured, the quality control officer selects 10 with replacement. What is the probability that there will be at least one defective tub among the 10 tubs selected?  
Round your answer to two decimal places.

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



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

	maximum score	points awarded
Part I	30	
Part II	70	
<b>Total score on written examination</b>	<b>100</b>	

\_\_\_\_\_ date

\_\_\_\_\_ examiner

	score rounded to <b>integer</b> / elért pontszám <b>egész számra</b> kerekítve	<b>integer</b> score entered in program / programba beírt <b>egész</b> pontszám
Part I / I. rész		
Part I / II. rész		

\_\_\_\_\_ examiner / javító tanár

\_\_\_\_\_ registrar / jegyző

\_\_\_\_\_ date / dátum

\_\_\_\_\_ date / dátum