ÉRETTSÉGI VIZSGA ● 2013. május 7.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2013. május 7. 8:00

I.

Időtartam: 45 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

EMBERI ERŐFORRÁSOK MINISZTÉRIUMA

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. Cancel ab to simplify the fraction $\dfrac{a^2b - 2ab^2}{3ab}$, where $ab \neq 0$.

The simplified fraction is	2 points	

2. The lengths of the sides of a rectangle are 12 cm and 5 cm. The rectangle is rotated about the line of one of its longer sides. What is the volume of the resulting solid of revolution? Explain your answer.

	2 points	
The volume of the solid of revolution:	1 point	

3. How many real roots does the equation $(x-5)(x^2+1) = 0$ have?

The number of real roots:	2 points	

4.   The function f is defined on the set of real numbers by the formula $f(x) = |x| - 4$. Find all those numbers x to which f assigns a value of 10.

The numbers x in question:	2 points	

5. F is the midpoint of a line segment AB. The position vector of point A is **a**, that of point F is **f**. Express the position vector **b** of point B in terms of the vectors **a** and **f**. Explain your answer.

	1 point	
The position vector of point B:	1 point	

6.   **e** is a given unit vector: **e** (cos 750° ; sin 750°). Determine the smallest angle through which the vector **i** (1 ; 0) may be rotated in the positive direction so that the resulting vector is **e**.

| The smallest possible positive angle:	2 points	

7. Find the real number(s) x for which the value of the function f, defined on the set of real numbers by the formula $f(x) = x^2 + 18x + 81$ is a minimum. Explain your answer.

	1 point	
$x =$	1 point	

8. How many positive five-digit numbers are there in base 2 notation?

There are .... positive five-digit numbers in base 2 notation.	2 points	

9.   In a survey, 720 people were asked about their habits of using the internet. The pie chart in the diagram represents the results: I never uses the internet; II uses the internet on a regular basis; III uses the internet occasionally. How many people belong to each group?
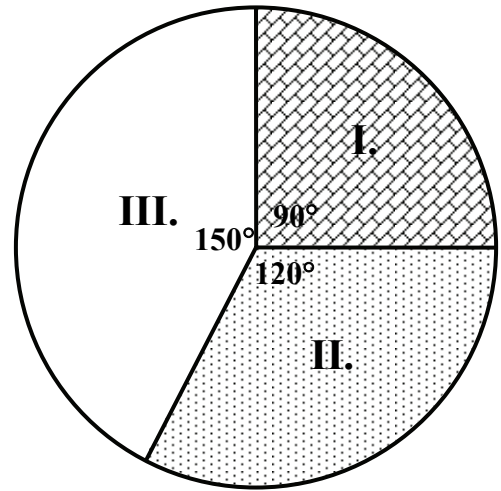
I.:		
II.:	3 points	
III.:		

10.   The line *e* passes through the point $A(5; -1)$ and is perpendicular to the line $2x = 7y$. Find the equation of the line *e*. Explain your answer.

	2 points	
The equation of the line:	1 point	

11. Decide about each of the statements below whether it is true or false.

A: If an even number is divisible by 9 then it is also divisible by 18.
B: Every number divisible by 100 is also divisible by 200.
C: There exists a number divisible by 100 that is also divisible by 13.
D: Only even numbers divisible by 3 are divisible by 6.

A: B: C: D:	4 points	

12. The first term of a sequence is −1, and the second term is 1. Each further term is obtained as the sum of the two preceding terms.
Calculate the sum of the first six terms of the sequence. Show your calculations.

	2 points	
$S_6 =$	1 point	

		maximum score	points awarded
Part I	Question 1	2	
	Question 2	3	
	Question 3	2	
	Question 4	2	
	Question 5	2	
	Question 6	2	
	Question 7	2	
	Question 8	2	
	Question 9	3	
	Question 10	3	
	Question 11	4	
	Question 12	3	
	TOTAL	**30**	

_____   _____
            date   examiner

	score rounded to **integer** / elért pontszáma **egész számra** kerekítve	**integer** score entered in program / programba beírt **egész** pontszám
Part I / I. rész		

_____   _____
    examiner / javító tanár   registrar / jegyző

_____   _____
        date / dátum   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

2013. május 7. 8:00

II.

Időtartam: 135 perc

| Pótlapok száma	
Tisztázati	
Piszkozati	

EMBERI ERŐFORRÁSOK MINISZTÉRIUMA

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**. 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.
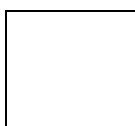
4. In solving the problems, you are allowed to use a calculator that cannot store and display verbal information. You are also allowed to use any book of four-digit data tables. The use of any other electronic devices, or printed or written material is forbidden.

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. Please **do not write anything in the grey rectangles.**

A

13.

a)   With two lines parallel to a side, a square is divided into three congruent rectangles. The perimeter of one such rectangle is 24 cm.
Find the area of the square in cm^2.

b)   The side of a square *ABCD* is 12 cm long. A line is drawn from vertex *A* that intersects side *BC* at a point *P*. Side *AP* of the resulting triangle *ABP* is 13 cm long.
Calculate the length of the altitude drawn to the hypotenuse of the right-angled triangle *ABP*.
Give your answer in centimetres, rounded to one decimal place.

a)	5 points	
b)	7 points	
T.:	12 points	

14.   Solve the following equations on the set of real numbers.
   a) $\lg(2x-5)=\lg x-\lg 3$
   b) $\sqrt{13-2x}=x-5$

a)	5 points	
b)	7 points	
T.:	12 points	

15. To be eligible to work at a certain research laboratory, a technician's certificate or a university diploma is required. There are 50 people employed at the lab. 42 of them have technician's certificates, and there are 28 with university degrees.

   a)   How many employees have technician's certificates only?

The average salary of the 50 people is 165 000 forints. The average salary of those under 30 years of age is 148 000 forints, and the average salary of the remaining employees is 173 000 forints.

   b)   How many people under 30 years work at the lab?

25 researchers would like to attend a conference at the weekend: 17 women and 8 men. The research institute can only finance the participation of 20% of the 25 applicants.

   c)   If the management decided to select at random whose expenses to cover, what would be the probability of their selecting women only?
   Round your answer to two decimal places.

a)	3 points	
b)	4 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 3.

16.   The lengths of two sides of a triangle are 20 cm and 22 cm.

    a)   How long may the third side be? How many such triangles are there in which the length of the third side is also an integer?

    b)   Given that the area of the triangle is 88 units, what may be the angle enclosed by the two sides?
Express the measure of the angle in degrees, rounded to one decimal place.

    c)   What may be the length of the third side under the conditions described in part **b)**?
Round the length of the side in question to one decimal place.

a)	5 points	
b)	4 points	
c)	8 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 3.

17. By letting offices under favourable conditions, a company supports young entrepreneurs starting their businesses. An office can be rented for a period of 24 months. The rent is 100 dollars for the first month and 200 dollars for the 24th month. From the second month onwards, the amount to pay is larger in each month than in the previous month. The tenants may choose from two options: They may either pay p% more each month than in the previous month, or they may pay d dollars more each month than in the previous month. Gábor chose the first option, and Péter chose the second option of paying the rent of their offices. (There are one hundred cents in a dollar.)

    a)   By what percentage will Gábor's rent increase each month?
              Round your answer to the nearest hundredth.
    b)   By how many dollars will Péter's rent increase each month?
              Round your answer to the nearest hundredth.
    c)   Which of the two men will pay more during the 24-month period?
              What is the difference between the amounts they will pay?
    d)   By what percentage will Péter's total rent in the second year exceed his total rent paid in the first year?

a)	5 points	
b)	3 points	
c)	6 points	
d)	3 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 3.

18. There are 6 crates in a row on the lowermost shelf next to the entrance of a food market. The manager instructed a worker to fill the crates with the following products: rice, sugar, flour, salt, semolina and bread crumbs. The manager also warned the worker to put only one kind of food in each crate, and not to place semolina and bread crumbs next to each other since they come in very similar packages and are therefore easy to mix up. There is no other restriction on the order of the six products on the shelf.

    a) In how many different orders may the worker arrange the six products on the shelf?

The manager has a contract with a bakery. Every day after closing, he is to name the amount of bread, bread rolls and croissants he wants for the following day. He orders three kinds of bread every day (1-kg loaves and ½-kg loaves of white bread, and rye bread). He also orders bread rolls and croissants every day.

Each of the five workdays during the 32nd calendar week, (Monday to Friday) he recorded how much of the ordered amount was sold, and how much remained. The quantity remaining was sent back to the baker. The statistics are tabulated below.

Number of pieces	day 1		day 2		day 3		day 4		day 5	
	sold	sent back	sold	sent back	sold	sent back	sold	sent back	sold	sent back
white, 1-kg loaves	**32**	**6**	**28**	**4**	**30**	**4**	**29**	**5**	**36**	**2**
white, ½-kg loaves	**19**	**1**	**20**	**4**	**18**	**2**	**20**	**5**	**18**	**2**
rye, loaves	**7**	**3**	**6**	**1**	**6**	**2**	**6**	**0**	**8**	**1**
rolls	**56**	**4**	**58**	**2**	**58**	**6**	**54**	**6**	**68**	**2**
croissants	**68**	**2**	**75**	**0**	**74**	**6**	**68**	**3**	**82**	**3**

    b) Calculate the total number of bread loaves, and also the total number of small bakery products (rolls and croissants together) ordered during the 5 days. For each of the two categories of products, calculate what percentage of the order was sent back.

    c) 2 days are selected at random out of the 5 days. What is the probability of a selection of two days, such that at least 130 pieces of small bakery products were sold on each day?

For each of the five products, the same amount was ordered on every day of the next (33rd) week. In the case of each of the three kinds of bread, the constant amount was the mean of the numbers sold per day during week 32, rounded to the nearest integer. In the cases of bread rolls and croissants, the constant amount was the median of the numbers sold per day during week 32.

    d) How many of each kind of product did the manager order daily during week 33?

a)	6 points	
b)	4 points	
c)	4 points	
d)	3 points	
T.:	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		
	TOTAL	**70**		

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

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           date   examiner

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

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examiner / javító tanár   registrar / jegyző

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    date / dátum   date / dátum