ÉRETTSÉGI VIZSGA ● 2015. május 5.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2015. május 5. 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 up, you will have to stop working.

2. You may solve the problems in any order.

3. On solving the problems, you may use a calculator that cannot store and display textual information. You may also use any edition of the four-digit data tables. The use of any other electronic device or printed or written material is forbidden!

4. **Enter the final answers in the appropriate frames.** You are only required to detail your solutions where you are instructed to do so by the problem.

5. Write in pen. Diagrams may be drawn in pencil. The examiner is instructed not to mark anything in pencil, other than diagrams. 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 attempts to solve a problem, please, indicate clearly which attempt you wish to be marked.

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

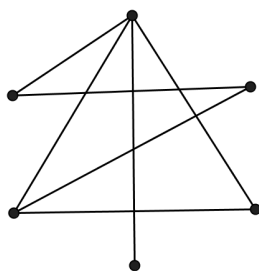**1.**   Sets *A*, *B*, and *C* are given by their elements:
$$A = \{1; 2; 3; 4; 5\},$$
$$B = \{3; 4; 5; 6; 7\},$$
$$C = \{6; 7; 8; 9; 10\}.$$

Give the sets $A \cap B$, $B \cup C$ and $A \setminus B$ by listing their elements.

$A \cap B =$	1 point	
$B \cup C =$	1 point	
$A \setminus B =$	1 point	

2.   Give the sum of the degrees of the vertices in the 6-point graph shown below.

The sum of the degrees:	2 points	

3.   Determine the truth value of the following statements (true or false).
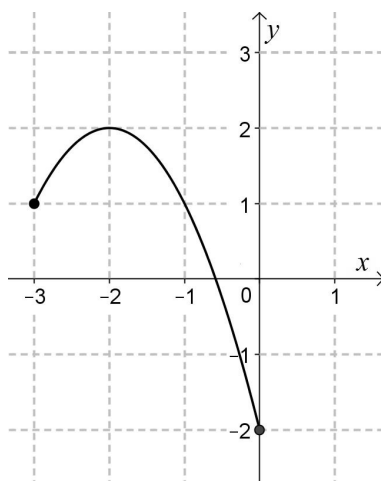
A) $16^{\frac{3}{4}} = 8$

B) The binary form of a number is 11100. The decimal form of the same number is 56.

C) The orthocentre of the right triangle coincides with one of the vertices of the triangle.

A) B) C)	2 points	

4.   Below is the graph of the function $x \mapsto -(x+2)^2 + 2$ that is defined on the interval $[-3; 0]$. Determine the range of this function.

The range:	2 points	

5. Complete the following operations and combine the like terms, wherever possible. Show your work.

$$(a+9)(a-1)+(a-4)^2$$

|		
	2 points	
The simplified form:	1 point	

6. The first term of geometric sequence is 2; the second term is –6.
   a) Determine the quotient of this sequence.
   b) Calculate the fourth term of the sequence.

The quotient:	1 point	
The fourth term:	1 point	

7. There are three children in a family. They were born two years one after the other, the sum of their ages is 45 years. How old is the oldest child?

The oldest child is years old.	2 points	

8. Graph the function $x \mapsto |x+1| - 2$ that is defined on the interval $[-2; 3]$.
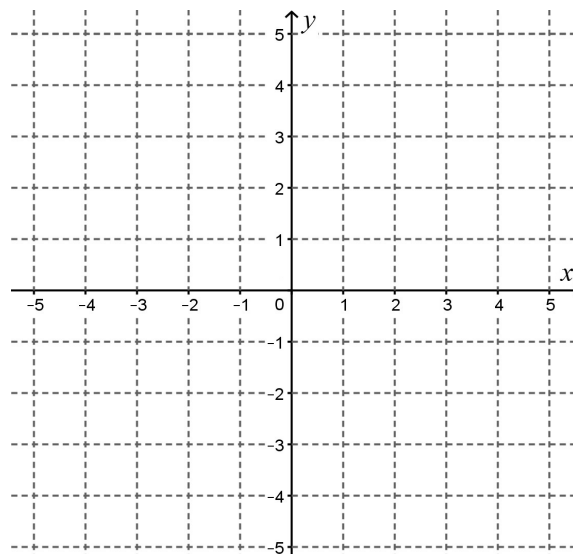
3 points	

9. The generator of a straight cone is 41 cm; the radius of the base circle is 9 cm. Calculate the height of the cone in centimetres. Show your work.

	2 points	
The height of the cone is cm.	1 point	

10. Give five positive integers such that their median is 4 and their mean is 3.

The five numbers:	3 points	

11. The equation of a circle is $x^2 + y^2 - 6y + 5 = 0$. Calculate the radius of the circle. Show your work.

	2 points	
The radius of the circle:	1 point	

12. A fair coin is tossed three times one after the other.
Give the probability that it comes up HEADS–TAILS–HEADS.

The probability:	2 points	

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

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          date   examiner

	elért pontszám **egész számra** kerekítve/score rounded to the nearest **integer**	programba beírt **egész** pontszám/ **integer** score entered into the program
I. rész/Part I		

_____   _____
   javító tanár/examiner   jegyző/registrar

_____   _____
       dátum/date   dátum/date

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

ÉRETTSÉGI VIZSGA ● 2015. május 5.

MATEMATIKA ANGOL NYELVEN

## KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2015. május 5. 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 up, 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 of the three problems. **When you have finished the examination, enter the number of the problem not selected in the square below**. *If it is not clear* for the examiner which problem you do not want to be assessed, the last problem in this examination paper will not be assessed.
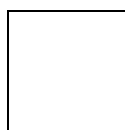
4. On solving the problems, you may use a calculator that cannot store and display textual information. You may also use any edition of the four-digit data tables. The use of any other electronic device or printed or written material is forbidden!

5. **Always write down the reasoning used in obtaining the answers. A major part of the points will be awarded for that.**

6. **Make sure that the calculations of intermediate results are also possible to follow.**

7. On solving the problems, theorems studied and given a name in class (e.g. the Pythagorean Theorem or the height theorem) do not need to be stated precisely. It is enough to refer to them by 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. Diagrams may be drawn in pencil. The examiner is instructed not to mark anything in pencil, other than diagrams. 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 case of more than one attempts to solve a problem, **indicate clearly** which attempt you wish to be marked.

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

A

13. The equation of line e is $3x + 7y = 21$.

   a) Point $P(-7; p)$ is on line e. Give the value of p.

Line f goes through point $Q(1; -2)$ and is perpendicular to line e.

   b) Give the equation of line f.

The equation of line g is $y = -\dfrac{3}{7}x + 5$.

   c) Prove that lines e and g are parallel.

a)	2 points	
b)	4 points	
c)	4 points	
T.:	10 points	

14. The sides of a rectangular sheet of paper are 12 and 18 cm long. Cut the four corners of the rectangle along the line segments connecting the points of trisection on adjacent sides, thus obtaining the octagon *ABCDEFGH*.

    a) Calculate the measure of the interior angle at vertex *B* of the octagon.

Highlight the sides of the octagon in red and all of its 20 diagonals in blue.
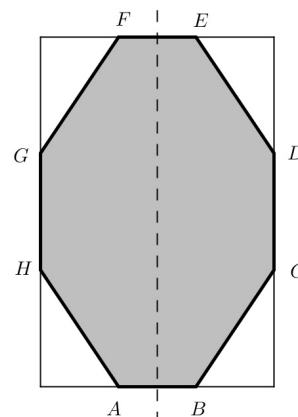
    b) Select three of these 28 segments at random. Calculate the probability that one of the selected segments will be red and the other two will be blue.

The octagon is rotated around the dotted line of symmetry (that is parallel to the longer side of the original rectangle).

    c) Calculate the volume of the solid of revolution obtained this way.

a)	3 points	
b)	4 points	
c)	7 points	
T.:	14 points	

15.   **a)** Evaluate the function $f: \mathbf{R} \to \mathbf{R}$, $f(x) = 3 \cdot 2^{x-1}$ at $x = 6$.

b) Solve the following equation in the set of real numbers.
$$3 \cdot 2^{x-1} = 0.375$$

c) The n-th term of a geometric sequence is $a_n = 3 \cdot 2^{n-1}$.
Calculate the sum of the first 10 terms of this sequence.

a)	2 points	
b)	6 points	
c)	4 points	
T.:	12 points	

B

You are required to solve any two of the problems 16 to 18. Enter the number of the problem not selected in the blank square on page 3.

16. During a census, the number and characteristics of families in Hungary are recorded. Each time a census is conducted, the number of dependent children living in each family is also recorded and the data is then compiled.

The table below shows the results obtained in the 1990 and the 2011 censuses.
(For example, 5% of all families raised 3 dependent children in 2011.)

Number of dependent children	Percentage of families	
	1990	2011
0	48%	52%
1	26%	25%
2	21%	16%
3	4%	5%
4 or more	1%	2%

It is also known that the total number of families was 2 896 thousand in 1990, and 2 713 thousand in 2011.

a) Calculate the percentage by which the number of families without any dependent children changed from 1990 to 2011.

b) Calculate the average number of dependent children per family in 2011. (In the case of families raising more than 4 dependent children calculate with 4.)

The number of households was also noted during the censuses. It decreased by 0.7% from 1990 to 2001, while from 2001 to 2011 it increased by 6.3% to a total 4 106 thousand in 2011.

c) How many households, to the nearest thousand, were there in 1990?

The number of single-person households was 946 thousand in 1990, increasing to 1 317 thousand by 2011. We would like to represent these numbers on a poster by two discs, such that the area of each disc is proportional to the number it represents. The 1990 data is shown as a disc of radius 4.5 cm.

Number of single-person households

1990   2011
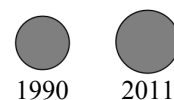
d) What should the radius of the disc for the year 2011 be?

a)	5 points	
b)	3 points	
c)	5 points	
d)	4 points	
T.:	17 points	

You are required to solve any two of the problems 16 to 18. Enter the number of the problem not selected in the blank square on page 3.

17. István's family is planning a holiday trip in the summer. They would like to travel from Debrecen to Baja by car. The route planner website offers two different routes. One involves mostly motorways, but it is 140 km longer than the other, which travels through towns as well.
The planner calculates with an average speed of $106 \dfrac{km}{h}$ for the longer route,

and an average of $71 \dfrac{km}{h}$ for the shorter one. As it happens, the duration of the trip turns out to be the same in both cases.

   a) Calculate the length of the shorter route.

Some time ago, István's family travelled from Debrecen to Badacsony by car. The length of that trip was 396 km. The average gas consumption of the car was 6.5 litres on 100 kilometres. One litre of gas cost 420 Ft.

   b) Calculate the total cost of gas for this trip.
      Round your answer to thousand forints.

After they had arrived, István calculated that travelling at an average speed $16 \dfrac{km}{h}$ higher than what they actually travelled at, the trip would have taken one hour less.

   c) Calculate the average speed of the car on this trip.

a)	6 points	
b)	3 points	
c)	8 points	
T.:	17 points	

You are required to solve any two of the problems 16 to 18. Enter the number of the problem not selected in the blank square on page 3.

18. On the cell phones of three graduating students the number of digits for the code to turn the phone on can be set.

Anna would like to set a five–digit code, such that only the digits 2 and 9 are used, both of them at least once.

   a) How many different codes can Anna choose from?

Béla's code is three-digit number that is divisible by six and all digits are different. Each digit is also a prime number and, reading left to right, the digits follow each other in decreasing order.

   b) Give Béla's code.

Gabi has forgotten her code. She knows it had six digits, two 3-s, two 4-s, a 5 and a 6 among them. Gabi selects one of such codes at random.

   c) Calculate the probability that she selects the correct code.

a)	5 points	
b)	6 points	
c)	6 points	
T.:	17 points	

	number of problem	maximum score	points awarded	total
Part II/A	13.	10		
	14.	14		
	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

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

_____   _____
   javító tanár/examiner   jegyző/registrar

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      dátum/date   dátum/date