ÉRETTSÉGI VIZSGA ● 2013. október 15.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2013. október 15. 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. The elements of set A are those whole numbers that are greater than –5 but smaller than 2. B is the set of positive whole numbers.
List the elements of the set $A \setminus B$.

$A \setminus B = \{ \quad \}$	2 points	

2. The function $f(x) = \lvert x - 4 \rvert$ is defined on the set of real numbers.
For what values x is $f(x) = 6$?

$x =$	2 points	

3. Solve the equation $\cos x = \frac{1}{2}$ on the closed interval [–π; π].

$x =$	2 points	

4. State the truth value (true or false) of each statement below.

A) The greatest common divisor of two different positive integers is always smaller than each number.

B) The greatest common divisor of two different positive integers always divides the sum of the two numbers.

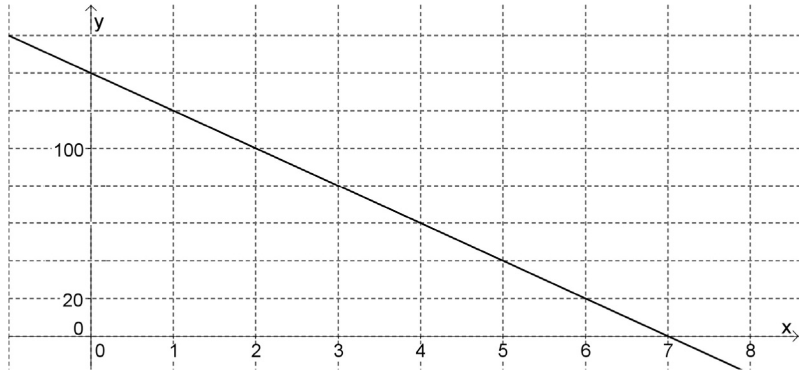
C) The greatest common divisor of two different positive integers cannot be 1.

A) B) C)	2 points	

5. In a certain country, 63.5% of the voting age population participated in the elections. 43.6% of the participants voted for the winning party.
How many voting age individuals are there if the winning party received 4 152 900 votes? Explain your answer.

	2 points	
There are voting age individuals.	1 point	

6. The diagram shows a part of the graph of the linear function $x \mapsto m \cdot x + b$.
Determine the value of b and the value of m.



$b =$	1 point	
$m =$	2 points	

7. The figure shows a triangular warning sign (radiation hazard). Which of the geometric transformations listed below map the figure onto itself?

A) Rotation through 60° about the centre of the sign.
B) Rotation through 120° about the centre of the sign.
C) Point reflection in the centre of the sign.
D) Line reflection in the axis passing through a vertex and the centre of the sign.

The letters marking the correct answer(s):	2 points	

8. The sixth term of an arithmetic sequence is 15, and its ninth term is 0.
Calculate the first term of the sequence. Explain your answer.

	2 points	
The first term of the sequence:	1 point	

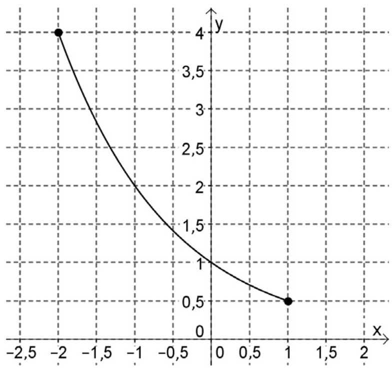
9. Draw a graph with 5 vertices, in which the sum of the degrees of the vertices is 12.

A graph satisfying the conditions:	2 points	

10. The diagram shows the graph of the function $f:[-2;1]\to \mathbf{R}$; $f(x)=a^x$.

a) Determine the range of the function *f*.

b) Find the value of the number *a*.

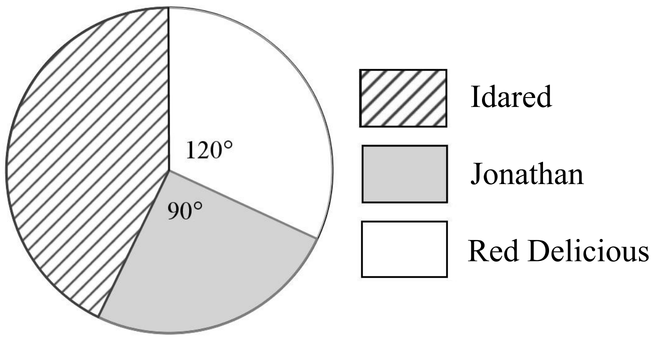


The range of *f*:	1 point	
$a =$	2 points	

11. What is the probability of the event that the number obtained by rolling a regular die once is a factor of 60? Explain your answer.

	2 points	
The probability in question:	1 point	

12. A greengrocer sells three kinds of apples in the market place. The pie chart represents the entire stock of his apples.
Fill in the appropriate fields of the table with the missing data.



Apple variety	The central angle of the circular sector (degrees)	Quantity (kg)	3 points	
Jonathan	90			
Idared				
Red Delicious	120	48		

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

date examiner

	elért pontszám **egész számra** kerekítve / score rounded to **integer**	programba beírt **egész** pontszám / **integer** score entered in 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, then this table and the signature section will 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.

ÉRETTSÉGI VIZSGA • 2013. október 15.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2013. október 15. 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**. When you have finished the examination paper, write in the square below the number of the problem not selected.** *If it is not clear* for 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 clear enough 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. **a)** Solve the following equation on the set of real numbers.

$$x + 4 = \sqrt{4x + 21}$$

b) Solve the following simultaneous equations where x and y denote real numbers.

$$\left.\begin{aligned} 3x + y &= 16 \\ 5x - 2y &= 45 \end{aligned}\right\}$$

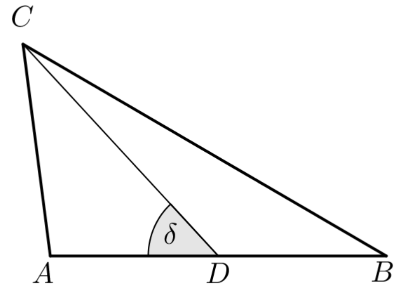
a)	6 points	
b)	6 points	
T.:	12 points	

14. In the triangle ABC shown in the figure, point D bisects side AB.
Given that $AB = 48$ mm, $CD = 41$ mm, and $\delta = 47°$,

a) calculate the area of triangle ABC.

b) verify by calculation that (rounded to the nearest whole millimetre) the length of side BC of the triangle is 60 mm.

c) calculate the measure of the interior angle at vertex B of the triangle.



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

15. In a school project, students of a graduating class conducted surveys with the student population of the school.

a) Éva questioned 150 students about household equipment in their homes. It turned out that twice as many students in her sample had microwave ovens as dishwashers. She also learnt that 63 students had both, and 9 had neither of the two devices.
What percentage of the students she questioned did not have microwave ovens at home?

b) Jóska asked 200 students in his survey about the number of computers they had in their households. He tabulated the answers as shown.

Number of computers in the household	Frequency
0	3
1	94
2	89
3	14

Use Jóska's survey to fill in the table below on the number of computers per household.

The mean of the number of computers	
The median of the number of computers	
The mode of the number of computers	

c) Based on his own survey, Tamás stated the following result:
There is a television in every household.
Select those two out of the four statements listed below that formulate the negative of the statement of Tamás.

A) There is no television in any household.
B) There is a household in which there is a television.
C) There is a household in which there is no television.
D) Not every household has a television.

The letters marking statements that are negations of the statement of Tamás:

a)	6 points	
b)	4 points	
c)	2 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. *Escherichia coli* is a bacterium shaped like a (cylindrical) rod, its length is 2 micrometres ($2 \cdot 10^{-6}$ m) on average, and its diameter is 0.5 micrometres ($5 \cdot 10^{-7}$ m).

a) Calculate the volume and surface area of a right circular cylinder of height 2 micrometres and diameter 0.5 micrometres.
Give your answers in m^3 and in m^2, respectively, expressed in scientific notation.

Under ideal laboratory circumstances, *E. coli* bacteria divide quickly and continually. Their number doubles every 15 minutes.
A nutrient solution initially contains about 3 million *E. coli* bacteria.

b) How many bacteria will there be in the nutrient solution in 1.5 hours?

The number of bacteria in the nutrient solution when t minutes have elapsed is given by the formula $B(t) = 3\,000\,000 \cdot 2^{\frac{t}{15}}$.

c) How many minutes does the number of *E. coli* bacteria in the nutrient solution take to reach 600 million?
Round your answer to the nearest whole minute.

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. Consider the points $A(1; –3)$ and $B(7; –1)$ in the coordinate plane.

a) Determine the equation of the line *e* passing through the points *A* and *B*.

b) Verify by calculation that the points *A* and *B* both lie on the circle *k* of equation $x^2 + y^2 - 6x - 2y = 10$, and calculate the length of the chord *AB*.

Line *f* passes through point *A* and is perpendicular to the line segment *AB*.

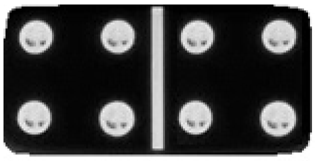
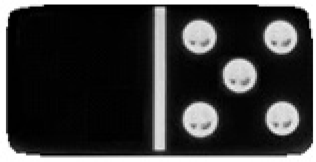
c) Calculate the coordinates of the intersection (different from *A*) of the circle *k* and the line *f*.

a)	4 points	
b)	4 points	
c)	9 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. **a)** A memory game consists of 30 cards of equal size that have one of the numbers 1, 2, 3, ... 14, 15 on one side. Every number occurs on exactly two cards. The other (back) sides of the cards all have the same design on them. The 30 cards are shuffled. The game starts by laying each card on the table face down, such that the numbers cannot be seen.
Calculate the probability that two cards selected at random at the beginning of the game will both have the same number on them.

b) A set of dominoes consists of domino stones of the same size. One side of each domino is divided into two halves with a line. The number of dots on each half may be anything from 0 to 6. Every possible pair exists, but there are no identical dominoes in the set. The diagram shows two dominoes: the 4-4 stone and the 0-5 (or 5-0) stone.
How many dominoes are there in a complete set?

c) In one version of the board game "Aggravation", players need to roll a six with a regular die to be able to start racing their tokens around the board.
Calculate the probability that a player needs to roll exactly three times to be able to start.

a)	5 points	
b)	6 points	
c)	6 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**	

date

examiner

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

javító tanár / examiner

jegyző / registrar

dátum / date

dátum / date