ÉRETTSÉGI VIZSGA • 2017. október 17.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2017. október 17. 8:00

I.

Időtartam: 57 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

EMBERI ERŐFORRÁSOK MINISZTÉRIUMA

Instructions to candidates

1. The time allowed for this examination paper is 57 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 by the problem to do so.

5. Write in pen. Diagrams may be drawn in pencil. The examiner is instructed not to mark anything written 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 case of more than one attempt to solve a problem, indicate clearly which attempt you wish to be marked.

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

1. The radius of the base circle of a straight cone is 5 cm, the height of the cone is 9 cm. Calculate the volume of the cone.

The volume of the cone: cm^3.	2 points	

2. The elements of set A are the positive divisors of 12.
The elements of set B are all the (positive) primes that are less than 15.
By listing their elements, give the sets A, B and $A \setminus B$.

$A =$ $B =$ $A \setminus B =$	3 points	

3. Give the value of x, if $5^x = (5^2 \cdot 5 \cdot 5^4)^3$.

$x =$	2 points	

4. The geometric mean of 8 and one other positive number is 12. Give the other number.

The other number:	2 points	

5. What digits may be written in place of c if the 6-digit number $\overline{64c39c}$ has to be divisible by 3? Explain your answer.

	2 points	
c =	1 points	

6. Give the number of edges in an 8-point complete graph.

The number of edges in the graph:	2 points	

7. Give the truth value (true or false) of the following statements:

A: Throw a fair dice once. The probability of throwing a square number is $\frac{2}{6}$.

B: Toss two fair coins. The probability of getting Tails on both of them is $\frac{1}{3}$.

C: One of the one-digit positive integers is selected randomly. The probability of selecting an even number is $\frac{4}{9}$.

A: B: C:	2 points	

8. Some of the 7 participants of a birthday party clinked glasses with some others. Would it be possible that the 7 respective participants clinked glasses with 1; 2; 2; 3; 3; 6; 6 others? Explain your answer.

	2 points	
Answer:	1 points	

9. Give the range of the function $x \mapsto x^2 - 1$ that is defined over the (open) interval]–2; 2[.

The range of the function:	3 points	

10. There are 5 data in a data set: 0; 1; 2; 3; 4.
Calculate the standard deviation of the above data.

The standard deviation:	2 points	

11. The function $x \mapsto \cos x$ is defined over the interval [0; 2π]. Find all values of x to which this function assigns $\frac{1}{2}$.

$x =$	2 points	

12. Anna, Bence, Cili and Dénes are sitting down randomly on a bench, next to one another. Calculate the probability that neither the two boys (Bence and Dénes), nor the two girls (Anna and Cili) are sitting next to each other. Explain your answer.

	3 points	
Answer:	1 points	

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

date

examiner

	pontszáma **egész számra** kerekítve	
	elért	programba beírt
I. rész		

dátum

dátum

javító tanár

jegyző

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!

ÉRETTSÉGI VIZSGA • 2017. október 17.

MATEMATIKA ANGOL NYELVEN

KÖZÉPSZINTŰ ÍRÁSBELI VIZSGA

2017. október 17. 8:00

II.

Időtartam: 169 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

EMBERI ERŐFORRÁSOK MINISZTÉRIUMA

Instructions to candidates

1. The time allowed for this examination paper is 169 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 to obtain the answers. A major part of the score will be awarded for this.**
6. **Make sure that calculations of intermediate results are also possible to follow.**
7. **The use of calculators** in the reasoning behind a particular solution **may be accepted without further mathematical explanation in case of the following operations**: addition, subtraction, multiplication, division, calculating powers and roots, $n!$, $\binom{n}{k}$, replacing the tables found in the 4-digit Data Booklet (sin, cos, tan, log, and their inverse functions), approximate values of the numbers π and e, finding the solutions of the standard quadratic equation. No further explanation is needed when the calculator is used to find the mean and the standard deviation, as long as the text of the question does not explicitly require the candidate to show detailed work. **In any other cases, results obtained through the use of a calculator are considered as unexplained and points for such results will not be awarded.**
8. 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*.
9. Always state the final result (the answer to the question of the problem) in words, too!
10. 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.
11. Only one solution to each problem will be assessed. In case of more than one attempt to solve a problem, **indicate clearly** which attempt you wish to be marked.
12. Please **do not write in the grey rectangles**.

A

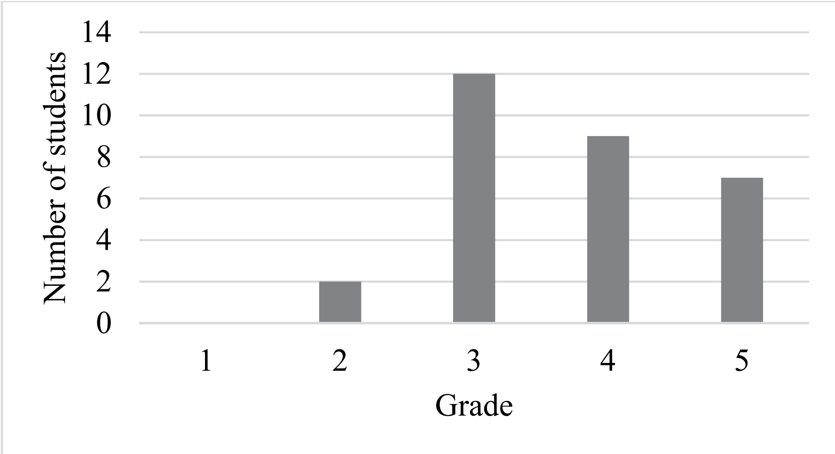
13. **a)** Solve the following equation in the set of real numbers:

$$(2x-3)^2 = x^2$$

b) How many (positive) three-digit odd numbers are there in the decimal system that consist of 3 different digits?

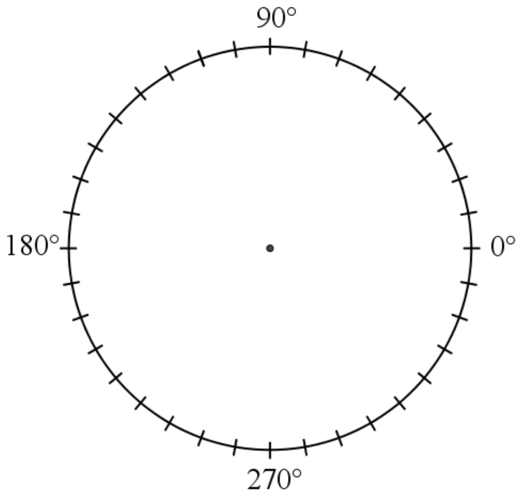
a)	5 points	
b)	5 points	
T.:	10 points	

14. The diagram shows the grade results of the Mathematics final exams of a class of 30 students.



a) Calculate the mean, median, and mode of the grades.

b) Show the distribution of the grades in a pie chart.

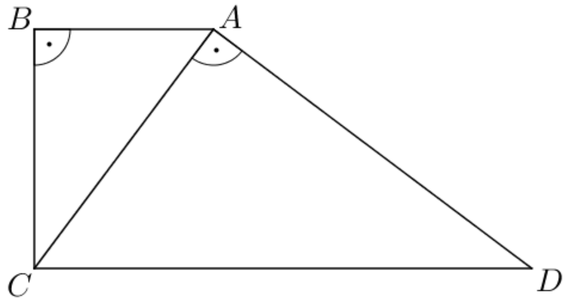


Two of the Mathematics final exam papers of this class are randomly selected and examined by the chairman of the examination board.

c) Calculate the probability that the grades on both of the selected papers will be 3-s. Round your answer to three decimal places.

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

15. The diagram shows two right triangles sharing a common side. As a result, the right-angled trapezium ABCD is obtained.



a) Prove that triangles *ABC* and *CAD* are similar.

Let *AB* = 9 cm and *AC* = 15 cm.

b) Calculate the measure of each angle on the side *AD* of the trapezium.

c) Calculate the area of the trapezium.

a)	3 points	
b)	4 points	
c)	7 points	
T.:	14 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 first mobile phones appeared in Hungary around the end of 1990. The number of subscriptions increased rapidly: by the end of 2002 there were 7 million subscribers nationwide, by the end of 2008 there were 12 million.

a) By what percentage did the number of subscribers increase from the end of 2002 to the end of 2008?

Between the years 1993 and 2001 the number of registered subscribers (in thousands) at the end of each year can be approximated by the function:

$f(x) = 51 \cdot 1{,}667^{x}$, where x is the number of years passed since the end of 1992.

b) Use the above function to determine the number of subscribers at the end of the year 2000.

In the beginning, the number of calls initiated in the mobile network system increased rapidly, too. In January, 1991 about 350 000 calls were initiated from mobile phones in Hungary. From this month on, the number of calls kept increasing by about 6.5% per month compared to the number of calls registered in the previous month (up until 2002).

c) In which year was the month when the number of mobile calls per month first reached 100 million?

The spread of mobile technology eventually led to a decrease in the number of traditional landline phone subscriptions as well as the number of calls made through that system. There were about 4200 million phone calls initiated through land lines in 2000, and this number decreased by 8% annually.

d) How many calls were initiated through land lines in 2009 and what was the total number of such calls in the ten-year period from the beginning of 2000 to the end of 2009?

a)	2 points	
b)	3 points	
c)	6 points	
d)	6 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. In the right-angled coordinate system given is the line *e*: $4x + y = 17$ and the points $C(2; 9)$ and $T(4; 1)$ on this line. Point *A* is the origin of the coordinate system.

a) Prove that the angle *ATC* is a right angle.

Point *B* is the reflected image of point *A* about the line *e*.

b) Calculate the coordinates of point *B*.

c) Give the coordinates of the centre of the circumcircle of the isosceles triangle *ABC*.

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. Contestants of a Mathematics competition have to solve 25 problems in 75 minutes. While preparing for the competition, Vera is trying to plan how much time she should spend on the easier problems and how much on the harder ones. She would spend one minute on the first problem. As problems are usually arranged in increasing order of difficulty, Vera plans to increase the amount of time spent on each problem, starting with the second one, in equal steps. She would like to make use of the full time of the competition.

a) According to this plan, how much time will Vera spend on the last 4 problems altogether?

The problems are multiple choice questions. To each problem there are 5 possible answers given. Contestants have to choose the one correct answer out of these five for each problem. The final score of each contestant is calculated as $4 \cdot C - I + T$ where C is the number of correct answers, I is the number of incorrect answers and T is the total number of problems (skipping a problem will earn 0 points on that problem). Vera skipped 3 problems of the total 25 and got a final score of 93 points.

b) How many of Vera’s answers were correct?

Eleven students from Vera’s class participated in the competition. Problem 24 was solved by exactly as many of them as problem 25. Moreover, this was also the number of students who solved neither of these two problems. There was only one person who solved both problem 24 and problem 25.

c) How many students were there in the class who solved problem 24, but did not solve problem 25?

a)	7 points	
b)	5 points	
c)	5 points	
T.:	17 points	

	number of question	score		
		maximum	awarded	total
Part II A	13.	10		
	14.	12		
	15.	14		
Part II B		17		
		17		
		← question not selected		
	TOTAL	**70**		

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

date

examiner

	pontszáma **egész számra** kerekítve	
	elért	programba beírt
I. rész		
II. rész		

dátum

dátum

javító tanár

jegyző