

**ÉRETTSÉGI VIZSGA • 2019. október 15.**

**MATEMATIKA  
ANGOL NYELVEN**

**KÖZÉPSZINTŰ  
ÍRÁSBELI VIZSGA**

**2019. október 15. 8:00**

**I.**

Időtartam: 57

Pótlapok száma	
Tisztázati	
Piszkozati	

**EMBERI ERŐFORRÁSOK MINISZTERIUMA**

## 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. Draw a 6-point graph such that the sum of the degrees of the vertices is 14.

2 points	
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2. List all subsets of the set  $A = \{x, y, z\}$ .

	3 points	
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3. What power of  $b$  is the result of the following operation equal to?

$$\frac{(b^2)^5 \cdot b^3}{b} \quad (b \neq 0)$$

	2 points	
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4. The original price of a pair of shoes was 15 000 Ft. They are now on sale for 9750 Ft. By what percentage has the original price been reduced?

By	percent.	2 points	
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5. Give a composite number that is co-prime (relatively prime) to 6.

	2 points	
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6. The functions below are defined over the set of real numbers. Select all even functions.

A)  $a(x) = 3x^2$

B)  $b(x) = x^3$

C)  $c(x) = |x|$

D)  $d(x) = 4x + 2$

	2 points	
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7. The first term of a geometric sequence is 6, the fourth term is 48. Determine the third term of this sequence.

	2 points	
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8. The length of side  $AB$  of triangle  $ABC$  is 2 units, the length of side  $BC$  is 3 units. The angle between these two sides is  $120^\circ$ . Calculate the length of side  $AC$ .

	2 points	
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9. The equation of a line is  $2x + 5y = 18$ . Determine the gradient (slope) of this line.

The gradient:	2 points	
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- 10.** The inner measures of a rectangular fish tank are: length 50 cm, width 20 cm, height 25 cm. How many centimetres below the top of the tank will the water level be if 19 litres of water is poured into it? Explain your answer!

	3 points	
	1 point	

- 11.** One number is randomly selected from each of the sets  $A = \{-13; -5; 29\}$  and  $B = \{-17; 0; 1; 4\}$ . Determine the probability that the product of the two numbers selected will be negative. Explain your answer.

	3 points	
	1 point	

- 12.** This year Samu's mathematics grades were: a 2, two 3-s, a 4, and four 5-s. Give the mean and the standard deviation of Samu's grades.

The mean of the grades:	1 point	
The standard deviation:	2 points	

		score	
		maximum	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	2	
	Question 10	4	
	Question 11	4	
	Question 12	3	
<b>TOTAL</b>		<b>30</b>	

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date

\_\_\_\_\_

examiner

	pontszáma <b>egész számra</b> kerekítve	
	elért	programba beírt
I. rész		

\_\_\_\_\_

dátum

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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!



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**MATEMATIKA  
ANGOL NYELVEN**

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ÍRÁSBELI VIZSGA**

**2019. október 15. 8:00**

**II.**

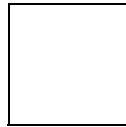
Időtartam: 169 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

**EMBERI ERŐFORRÁSOK MINISZTERIUMA**

## 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  $\pi$  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

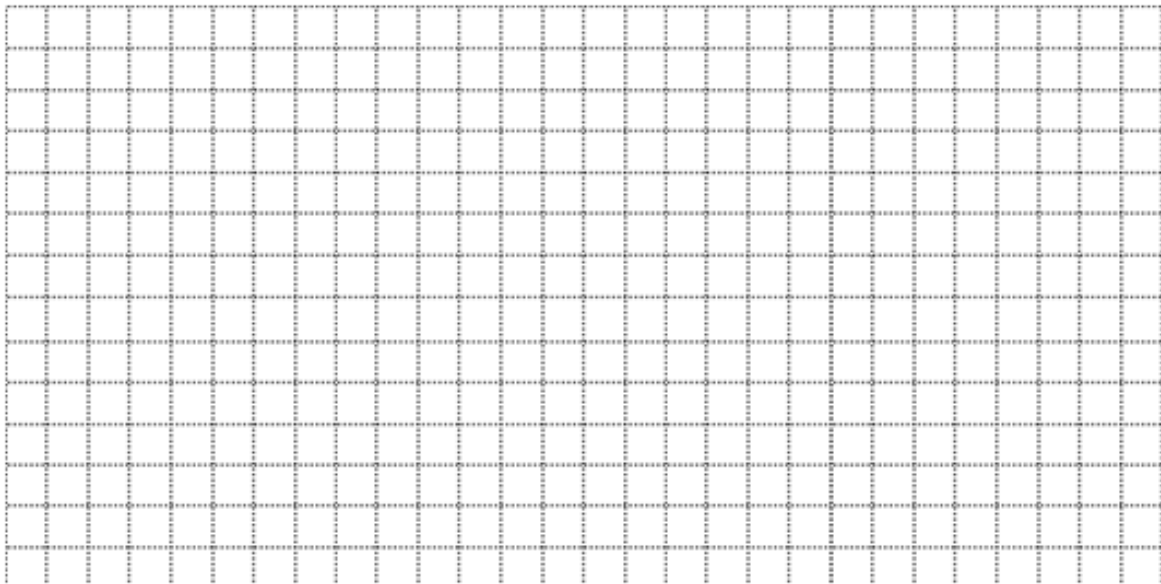
**13.** The function  $f: x \mapsto -\frac{1}{2}x + 4$  is defined over the closed interval  $[-2; 4]$ .

- a) What value does function  $f$  assign to  $x = -\frac{3}{4}$ ?
- b) Draw the graph of function  $f$ .  
Give the range of function  $f$ .

The function  $g: x \mapsto x^2 - 4x + 3$  is defined over the set of real numbers.

- c) How many numbers are there to which function  $g$  assigns the value  $\left(-\frac{3}{4}\right)$ ?

<b>a)</b>	2 points	
<b>b)</b>	5 points	
<b>c)</b>	4 points	
<b>T:</b>	11 points	





**14.** Statistical data shows that, year by year, one of the main reasons behind road accidents is careless driving, the lack of attention.

- a)** A car travels at a speed of 120 km/h on the highway. The driver does not pay attention for 1.5 seconds. How far does the car travel during this time period?

Another frequent cause for accidents is speeding. Experience shows that the average speed of a driver who never exceeds the 130 km/h speed limit is around 120 km/h. The distance between Siófok and Budapest is about 100 km.

- b)** Calculate how many minutes shorter it takes to travel the Siófok–Budapest route if a driver keeps an average speed of 130 km/h instead of 120 km/h.

A total of 1178 road traffic accidents were registered in Hungary in January, 2018, that resulted in personal injury. In 440 of these cases the cause of the accident was speeding. We would like to represent various causes of accidents in a pie chart.

- c)** What central angle belongs to the sector representing speeding in this pie chart?

<b>a)</b>	4 points	
<b>b)</b>	4 points	
<b>c)</b>	3 points	
<b>T:</b>	11 points	



- 15.** a) The sum of the first and third terms of an arithmetic sequence is 8. The sum of the third, fourth and fifth terms is 9. Give the sum of the first ten terms of this sequence.
- b) One leg of a right triangle is 8 cm shorter than the hypotenuse. The other leg is 9 cm shorter than the hypotenuse. How long are the sides of this triangle?

<b>a)</b>	7 points	
<b>b)</b>	7 points	
<b>T:</b>	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 2.**

**16.** A sheet of A4 paper has been cut into four smaller, identical cards. The cards have been labelled with the numbers 1, 2, 3 and 4, one number on each card. The four cards are now arranged in order at random.

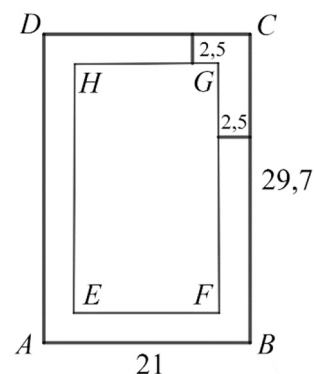
- a) Calculate the probability that there will be neither two consecutive even numbers, nor two consecutive odd numbers in this arrangement.

The thickness of an A4 sheet is 0.1 mm. Cut this sheet in half and place the two halves on top of one another. Cut this pack in half again and once again place all four quarters on top of one another. (The thickness of the pile is now 0.4 mm.) Continue this routine, cutting the pile in half and then placing the halves on top of one another. This will be done 20 times altogether. Luca believes that after 20 cuts and replacements the height of the resulting pile will be more than 100 metres.

- b) Is Luca right? Justify your answer by calculations.

The dimensions of an A4 sheet of paper are 21 cm  $\times$  29.7 cm. Word processors typically leave a 2.5 cm margin, i.e. a 2.5 cm wide strip remains blank on all four sides of the page (see diagram). The middle section where the text will be is also rectangular.

Zsófi says that rectangles  $ABCD$  and  $EFGH$  are similar.



- c) Is Zsófi right? Justify your answer by calculations.

Consider the statement:

*If two quadrilaterals are similar, their corresponding pairs of angles are congruent.*

- d) Give the truth value of the above statement (true or false).  
Give the converse of the statement and determine the truth value of the converse.  
Justify your answer about the converse.

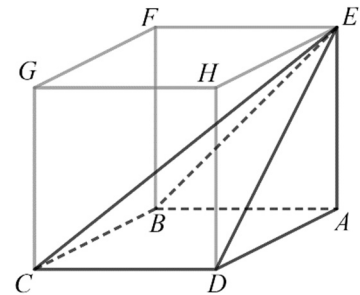
<b>a)</b>	4 points	
<b>b)</b>	4 points	
<b>c)</b>	5 points	
<b>d)</b>	4 points	
<b>T:</b>	17 points	



**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 2.**

**17.** The length of the edges of cube  $ABCDEFGH$  is 6 cm.

- a) Calculate the surface area of the pyramid  $ABCDE$  seen in the diagram.
- b) Express vector  $\vec{EC}$  in terms of vectors  $\vec{AB}$ ,  $\vec{AD}$  and  $\vec{AE}$ !



The radius of the base circle of a straight cone is 6 cm, the height of the cone is 12 cm.

- c) Calculate the angle between the generator (slant height) of the cone and the plane of the base circle.

The above cone is cut by a plane parallel to the base. The distance between the plane of the base and the plane of the cut is 3 cm.

- d) Calculate the volume of the resulting truncated cone.

a)	6 points	
b)	3 points	
c)	3 points	
d)	5 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 2.**

**18.** There are 65 rooms in a hotel that accommodate a total of 125 people. The rooms are either single (one bed), double (2 beds) or triple (3 beds).

a) How many triple rooms are there in the hotel if the number of double rooms is three times as much as the number of single rooms?

A group of 6 people arrive at the hotel: Aladár, Balázs, Csaba, Dezső, Elemér and Ferenc. Aladár and Balázs are brothers. The group is given the single room 101, the double room 102, and the triple room 103.

The receptionist places the keys on the counter: one for room 101, two for room 102, and three keys for room 103. Each member of the group then randomly picks up one of the keys (thereby selecting their rooms).

b) Calculate the probability that Aladár and Balázs will share room 102.

Soon after their arrival the guests were having dinner in the dining hall of the hotel. While waiting for their meals, they saw a waiter accidentally dropping and breaking a plate. Waiters do occasionally break plates, one in two thousand on average (this may as well be considered as a probability of  $\frac{1}{2000}$  for breaking an arbitrary plate). During the next dinner waiters will serve a total of 150 plates.

c) Calculate the probability that the waiters will break at least one plate during the next dinner.

<b>a)</b>	7 points	
<b>b)</b>	6 points	
<b>c)</b>	4 points	
<b>T:</b>	17 points	



	number of question	score		
		maximum	awarded	total
Part II A	13	11		
	14	11		
	15	14		
Part II B		17		
		17		
		← question not selected		
<b>TOTAL</b>		<b>70</b>		

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

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date

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examiner

	pontszáma <b>egész számra</b> kerekítve	
	elért	programba beírt
I. rész		
II. rész		

\_\_\_\_\_

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jegyző