

**ÉRETTSÉGI VIZSGA • 2018. október 16.**

**MATEMATIKA  
ANGOL NYELVEN**

**KÖZÉPSZINTŰ  
ÍRÁSBELI VIZSGA**

**2018. október 16. 8:00**

**I.**

Időtartam: 57 perc

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 Booklet. 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 not required to detail your solution unless 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 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. **Do not write in the grey rectangles.**

1. In a class of 25 students, every student takes maturation examinations in English language or in Information technology. 21 students take an exam in English language and 8 students take an exam in Information technology.  
Find the number of students who take an examination in English language, but not in Information technology.

There are ..... such students.	2 points	
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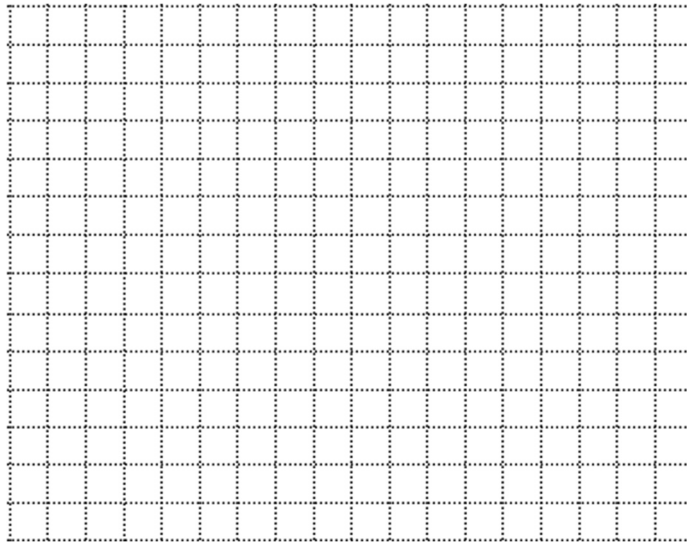
2. Two fair coins are tossed once. Find the probability of getting two heads.

The probability is	2 points	
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3. In a tournament seven teams play matches so that each team plays against every other team once. 9 matches have already been played. How many matches are still to be played?

	2 points	
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4. Where does the graph of function  $x \mapsto -2x + 6$  ( $x \in \mathbf{R}$ ) intersect the axes of the coordinate system?



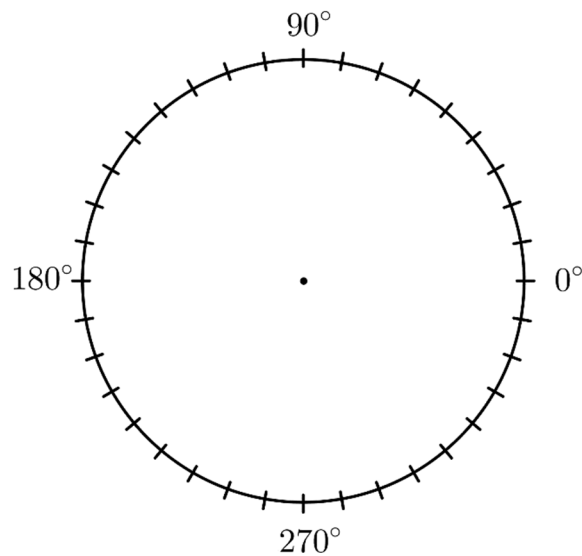
It intersects the x-axis at:	1 point	
It intersects the y-axis at::	1 point	

5. Determine the truth value (true or false) of the following statements:

- A) There exists a graph with five vertices of degrees 0; 1; 2; 4; 2.  
 B) There exists a rectangle, which is also a kite.  
 C) Number  $\frac{4.17}{3}$  is rational.

A) B) C)	2 points	
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6. In a cake shop on a given morning there are three types of products: 32 muffins, 100 slices of cake and 12 brownies.  
Draw a pie chart representing the distribution of the three types of products in the shop at the time of opening.  
Show your work.



4 points	
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7. Set A is a closed interval  $[-7; 8]$ , set B is a closed interval  $[2; 12]$ . Determine set  $A \cap B$ .

$A \cap B =$	2 points	
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8. "Every mouse likes cheese."

Choose the one from the sentences below which is the negation of the above statement.

- A) Every mouse likes walnut.
- B) There isn't any mouse that likes cheese.
- C) There exists a mouse that doesn't like cheese.
- D) There exists a mouse that likes cheese.

	2 points	
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9. Function  $x \mapsto 3 + \sin x$  is defined on the set of real numbers. Find the range of the function.

	2 points	
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10. A Hungarian deck consists of 32 cards. There are four colours (acorns, hearts, leaves and pumpkins) and in case of each colour there are eight different cards (VII, VIII, IX, X, Lower, Upper, King, Ace).  
How many different ways can 3 cards be drawn from the 32-cards deck if the *ace of hearts* is to be among them?



	2 points	
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- 11.** In an arithmetic sequence the fourth term is 8, the fifth term is 11.  
Calculate the sum of the first ten terms of this sequence. Show your work.

	3 points	
	1 point	

- 12.** A box contains six pieces of chocolate, the mass of each single one (measured in grams) are as follows:

15; 14.7; 15.3; 14.9; 15.2; 14.9.

Find the range, mean and standard deviation of the mass of chocolates in grams.

Range:	grams	1 point	
Mean:	grams	1 point	
Standard deviation:	grams	2 points	

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

\_\_\_\_\_

date

\_\_\_\_\_

examiner

	pontszáma <b>egész számra</b> 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!



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**II.**

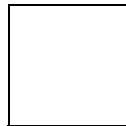
Időtartam: 169 perc

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 Booklet. 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,  $n!$ ,  $\binom{n}{k}$ , using values from the tables in the four-digit Data Booklet (sin, cos, tan, log, and their inverse functions), using 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 altitude 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. **Do not write in the grey rectangles.**

**A**

- 13.** a) In a fraction, the numerator is less than the denominator by 119. The fraction can be simplified into the form of  $\frac{4}{11}$ . Find the original form of the fraction.
- b) In the denominator of fraction  $\frac{100}{n}$ ,  $n$  is substituted by a random positive integer not greater than 100. Find the probability that the fraction obtained is an integer.

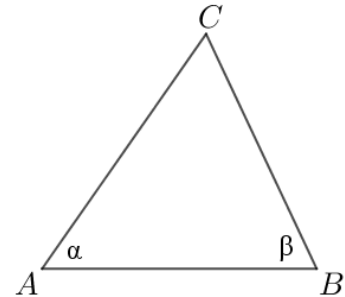
<b>a)</b>	5 points	
<b>b)</b>	5 points	
<b>T.:</b>	10 points	



**14.** Two points are given in the Cartesian coordinate system:  $P(-2;3)$  and  $K(3;15)$ .

- a)** Let  $P'$  be the image of point  $P$  when reflected through point  $K$ . Find the coordinates of  $P'$ .

$\alpha = 55^\circ$ ,  $\beta = 65^\circ$  are two angles of triangle  $ABC$ . Let point  $M$  be the intersection of the altitudes passing through vertices  $A$  and  $B$ . The image of point  $M$  when reflected across line  $AB$  is denoted by  $M'$ .



- b)** Calculate the interior angles of quadrilateral  $AM'BC$ .

<b>a)</b>	4 points	
<b>b)</b>	8 points	
<b>T.:</b>	12 points	



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

$$\frac{x}{x+2} = \frac{8}{(x+2)(x-2)}$$

**b)** Solve the following inequality in the set of real numbers.

$$\frac{x}{x+2} < 0$$

**c)** Find the  $x$  value where  $f$  has the minimum, and the minimum value of function  $f(x) = x^2 - 6x + 5$ .

<b>a)</b>	6 points	
<b>b)</b>	4 points	
<b>c)</b>	4 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.**

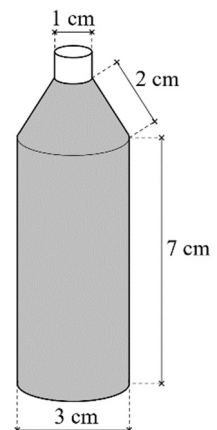
- 16.** Cili suffered an injury on a training, and had to undergo knee surgery. Each day after the day of the surgery, she had to walk a given distance prescribed by the physiotherapist. On the first day after the surgery she walked only 20 meters, then increased this distance each day by walking 15% more than on the previous day.

- a) During a daily walk she said: “I walked 1000 meters so far today”.  
How many days after the surgery could she say this for the first time?

In order to quicken the healing process after surgery, Cili takes liquid vitamin drops. Her daily dose is  $2 \times 25$  drops. The volume of 20 drops is approximately 1 millilitre. 1 millilitre of the liquid contains 100 milligrams active ingredient.

- b) How many milligrams of active ingredient does Cili’s daily dose contain?

The liquid vitamin drops are sold in a drug bottle that is made up of two cylindrical and one truncated cone shaped parts. The bottle is filled up with liquid to the level of the top of the truncated cone. The dimensions of the *inside* of the bottle are shown in the diagram. The bigger cylinder has a diameter of 3 cm and a height of 7 cm. The diameter of the top of the truncated cone is 1 cm, while its slant height is 2 cm.



- c) How many days does a bottle of vitamin drops last, if Cili takes the drops in her prescribed daily dose?

a)	6 points	
b)	2 points	
c)	9 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.**

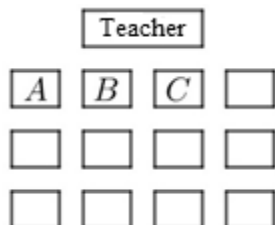
17. Barnabás has a mobile phone with a screen, whose diagonal is 5.4 inch (1 inch  $\approx$  25.4 mm). The ratio of sides of the screen is 16:9. The front panel of the mobile phone is rectangular and has a 12-12 mm black rim at the top and bottom and a 3-3 mm black rim at the sides.



- a) Find the side lengths of the front panel.  
Round your answer to the nearest mm.

Before starting the examination, the examiner asks candidates to switch off their mobile phones and place them onto the teacher's desk. The probability that a candidate forgets to switch off his or her mobile due to pre-exam jitter is 0.02.

- b) Find the probability that at least one candidate out of the 12 being present in the examination room forgets to switch off his or her mobile phone.



In the examination room there are 12 one-person desks in four columns as shown. Each column consists of three desks. Julcsi and Tercsi are good friends, so they want to sit at neighbouring desks. (e.g. If Julcsi sits at desk B, then Tercsi will sit at either desk A or C).

- c) How many different ways can the 12 candidates be seated so that Julcsi and Tercsi sit at neighbouring desks?

The table on the right shows the distribution of scores in a mathematics maturation examination in the case of 100 students.

Score	Number of students
0-20	0
21-30	8
31-40	12
41-50	8
51-60	18
61-70	20
71-80	12
81-90	16
91-100	6

- d) What is the greatest possible value of the mean of scores for these 100 students?

a)	6 points	
b)	3 points	
c)	5 points	
d)	3 points	
<b>T.:</b>	17 points	

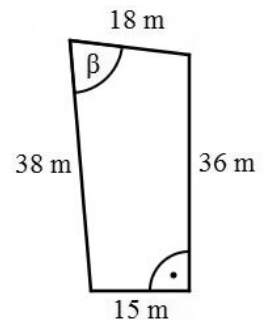


**You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 2.**

- 18.** Mr and Mrs Molnár have just bought a plot of land. Five years ago they deposited a sum of 7 000 000 HUF on a bank account at a fixed rate, compounded annually. At the end of the fifth year they withdrew an amount of 8 115 000 HUF from their bank account.

- a) Find the interest rate paid by the bank annually, assuming that the interest rate remained constant throughout the five years.

The plot of land is in a zone, where 20% of the total area can be built on. The figure on the right shows the shape and size of the plot of land. The sides that are 15 m and 36 m long enclose a right angle.



- b) Find the angle ( $\beta$ ) enclosed by the 18 m and 38 m long sides and calculate the area that can be built on.

Mr Molnár has four identical-looking keys on his ring. One of these keys opens the gate of the new plot of land, but Mr Molnár's first attempt at inserting the right key into the lock of the gate is usually unsuccessful.

- c) Find the probability that Mr Molnár's first attempt at opening the gate is unsuccessful, but his second attempt is successful. (Mr Molnár tries to insert two different keys into the lock.)

a)	4 points	
b)	9 points	
c)	4 points	
<b>T.:</b>	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		
<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>	

\_\_\_\_\_ date

\_\_\_\_\_ examiner

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

\_\_\_\_\_ dátum

\_\_\_\_\_ dátum

\_\_\_\_\_ javító tanár

\_\_\_\_\_ jegyző