

**ÉRETTSÉGI VIZSGA • 2020. május 5.**

**MATEMATIKA  
ANGOL NYELVEN**

**KÖZÉPSZINTŰ  
ÍRÁSBELI VIZSGA**

**2020. május 5. 9:00**

**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 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 first term of a geometric progression is 8, the common ratio is 2.  
Give the sum of the first 10 terms of this progression.

The sum of the first 10 terms:	2 points	
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2. Shown in the table below are the maximum daily temperatures throughout a week in April.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Temperature (°C)	20	21	21	17	17	18	21

Give the median of the data.

The median:	2 points	
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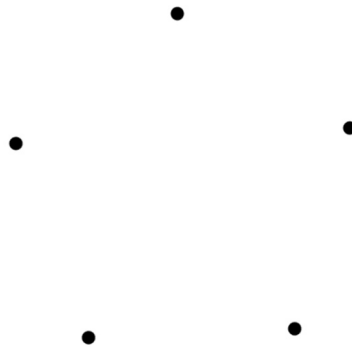
3. Two sets,  $A$  and  $B$  are given. The cardinality (number of elements) of set  $A$  is 6, the cardinality of set  $A \cup B$  is 7, while the cardinality of set  $A \cap B$  is 2.  
What is the cardinality of set  $B$ ? Explain your answer.

	2 points	
The cardinality of set $B$ is:	1 point	

4. There are 8 sailboats competing in a boat race.  
Calculate the number of possible orders in which they can finish the race, given that all of the boats finish and there can be no ties.

The number of possible orders:	2 points	
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5. Complete the diagram below into a 5-point graph that has 7 edges and the degree of each point is no more than 3.



2 points	
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6. Given are ten integers: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, one of which is selected at random.  
Calculate the probability that the number selected is a square number.

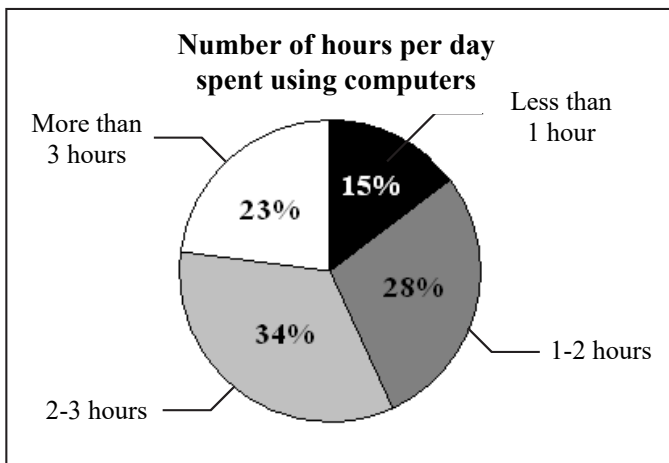
The probability:	2 points	
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7. Determine the truth value (true or false) of the following statements:

- A) If a 10-forint coin is tossed a 100 times in a row, it will end up Heads exactly 50 times, while we will get Tails in the other 50 cases.
- B) The probability of winning the 5-out-of-90 lottery with the numbers 1, 2, 3, 4, 5 is exactly the same as the probability of winning with the numbers 9, 23, 46, 75, 86.
- C) Two fair dice are thrown at the same time. In this case, the probability of both showing 6 is  $\frac{1}{36}$ .

A:		
B:	2 points	
C:		

8. In a survey, 1200 people were asked about the number of hours they spent using computers each day. The (percentage) results are shown in the pie chart. Calculate the number of people asked in this survey who spent no more than 3 hours a day using computers. Explain your answer.



	2 points	
Number of people spending no more than 3 hours per day using computers:	1 point	

9. Give the equation of the line that is parallel to the line  $2x - 5y = 10$  and crosses the point  $P(4; 1)$ .

The equation of the line:	2 points	
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10. The fourth term of an arithmetic progression is 72, the sixth term is 64. Determine the first term of the progression. Explain your answer.

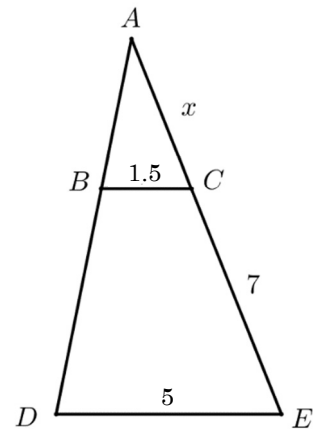
	3 points	
The first term of the progression:	1 point	

11. Solve the following equation in the interval  $[0; \pi]$ .

$$\tan x = -1$$

$x =$	2 points	
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- 12.** In the diagram shown, segment  $BC$  is parallel to segment  $DE$ . The following distances are also known:  $BC = 1.5$ ;  $DE = 5$ ;  $CE = 7$ . Calculate the length of segment  $AC$ . Explain your answer.



	3 points	
The length of segment $AC$ :	1 point	

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

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date

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examiner

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

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dátum

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javító tanár

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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  
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**2020. május 5. 9:00**

**II.**

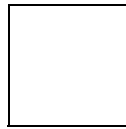
Időtartam: 169 perc

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**.

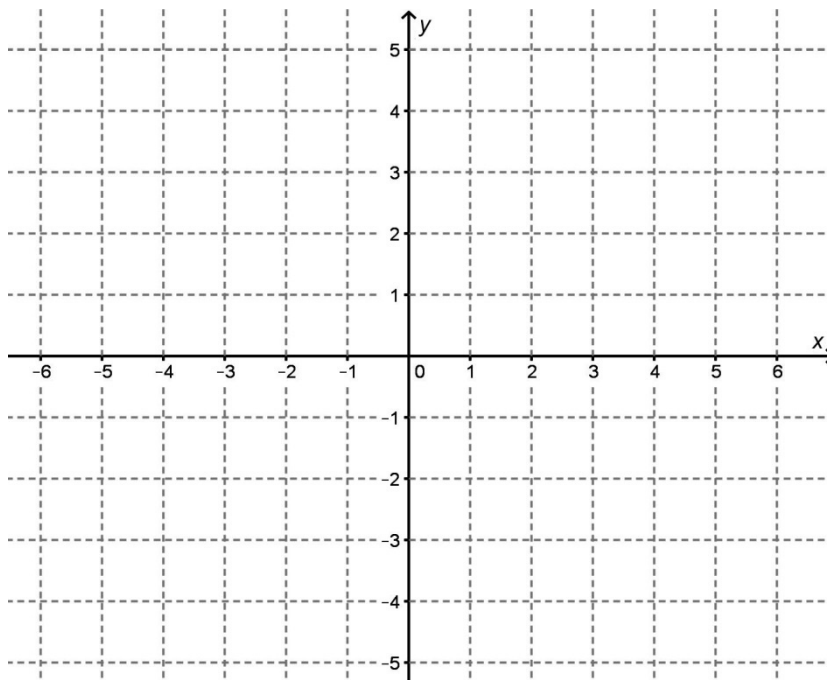
**A**

**13.** Given is the function  $f: [-2; 4] \rightarrow \mathbf{R}, x \mapsto |x - 2| - 1$ .

**a)** What value does function  $f$  assign to  $(-1)$ ?

**b)** Draw the graph of function  $f$  and describe it in terms of monotonicity, extreme(s), zero(s), range.

<b>a)</b>	2 points	
<b>b)</b>	10 points	
<b>T.:</b>	12 points	





**14.** Solve the following equations in the set of real numbers.

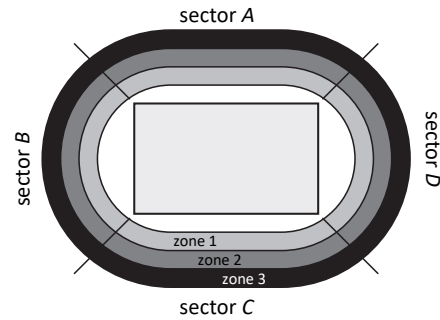
**a)**  $\frac{1}{2} + \frac{x-2}{x+2} = \frac{2x+1}{2 \cdot (x+2)}$

**b)**  $\log_3(x^2 - 1) + \log_3 81 = 5$

<b>a)</b>	5 points	
<b>b)</b>	6 points	
<b>T.:</b>	11 points	



15. The seating area of a stadium is divided into four sectors: *A*, *B*, *C*, and *D*. Each sector is also further divided into three zones: zone 1 includes the rows of seats nearest to the field, zone 2 includes the middle rows of seats, while the seats in the back form zone 3.



Shown in the – incomplete – table below are the numbers of tickets sold to different zones and sectors for a particular game.

	sector <i>A</i>	sector <i>B</i>	sector <i>C</i>	sector <i>D</i>
zone 1	69	96	85	
zone 2	116	99		
zone 3	102	113		

It is known that, in zone 1, an average of 82 tickets per sector were sold.

- a) How many tickets were sold for zone 1 of sector *D*?

It is also known that the total number of tickets sold for the game was 1102.

- b) What is the probability that a randomly selected spectator holds a ticket for either sector *C* or sector *D*?

For the three zones of sector *C* a total of 295 tickets were sold, for 752 200 forints altogether. A ticket in zone 1 of sector *C* costs 3200 Ft, in zone 2 of sector *C* it is 2900 Ft, while in zone 3 of sector *C* it is 1500 Ft.

- c) How many tickets were sold for zone 2 of sector *C* and how many for zone 3 of sector *C*?

a)	3 points	
b)	3 points	
c)	7 points	
<b>T.:</b>	13 points	





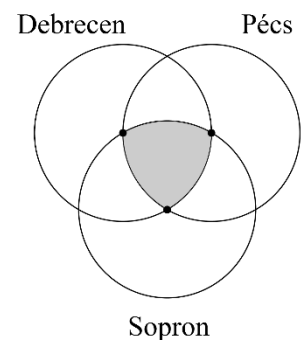
## B

**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.** There are 30 students in a class. The students are planning a class trip. The possible destinations are either Sopron, or Debrecen, or Pécs. The students vote about which destination(s) they prefer. Each student may vote for more than one options, but everyone must select at least one place. Here are the results of the vote:
- 18 students voted for Sopron, 8 of whom would also go to Pécs.
  - 20 students would visit Debrecen, 12 of whom would accept Sopron, too.
  - 11 students would go to Pécs and Debrecen.
  - 5 of the students voted for all three places.

- a)** How many students are there in this class who would go to Pécs at all?

János made a diagram showing the results of the vote. The radius of each circle in his diagram is 3 cm and each circle goes through the centres of both other circles.



- b)** Calculate the area of the intersection of all three discs.

We already know that 20 out of the 30 students voted for Debrecen as a possible destination. Three students from this class are selected at random.

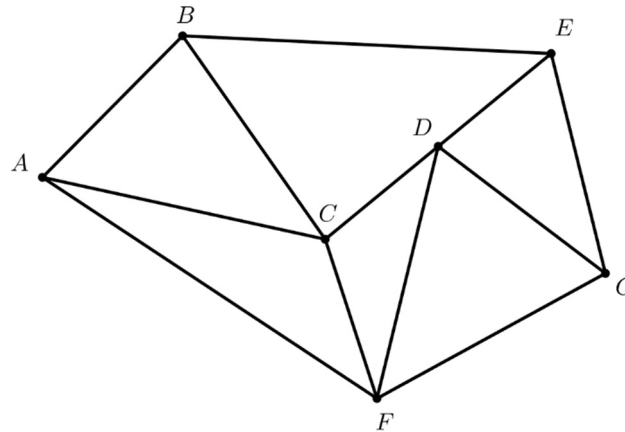
- c)** What is the probability that exactly two of these three students would visit Debrecen, while the third of them would not?

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

**17.** Use this diagram to solve problems a), b), and c) below.



In triangle  $ABC$ ,  $AB = 37$  units,  $BC = 41$  units, the measure of angle  $BAC$  is  $60^\circ$ .

**a)** Calculate the perimeter of triangle  $ABC$  rounded to the nearest integer.

Point  $D$  is the midpoint of the line segment  $CE$ .

**b)** Express vector  $\overrightarrow{BE}$  in terms of vectors  $\overrightarrow{AB}$ ,  $\overrightarrow{AC}$ , and  $\overrightarrow{CD}$ .

Starting from point  $A$ , we would like to travel to point  $G$  so that we may only travel on the line segments drawn between points and the letter for each consecutive point must be further back in the alphabet than that of the previous point. (For example: leaving point  $C$ , we may move on to points  $D$  or  $F$ , but we may not move to points  $A$  or  $B$ .)

**c)** How many different routes are there to travel from point  $A$  to  $G$  this way?

<b>a)</b>	7 points	
<b>b)</b>	4 points	
<b>c)</b>	6 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.** The shape of a teapot is roughly that of a truncated cone. The diameter of the base circle of the teapot is 18 cm, the diameter of the top circle is 8 cm. The distance from top to bottom on the side of the teapot (i.e. the slant height of the truncated cone) is 14 cm. The teapot is filled with tea up to half of its height.



- a)** How many decilitres of tea is there in the teapot?

It is a well-known fact that, when left alone, hot tea eventually cools to the temperature of the surrounding air. The nature of this cooling process is an exponential decay. In an experiment a pot of hot tea was left alone in a 23°C room and the temperature of the tea was then measured periodically. Entering the temperature data into a computer, the following equation was established for the temperature  $T$  (in °C) of the tea:

$$T_{\text{tea}}(t) = 23 + 56 \cdot 0.96^t$$

where  $t$  is the total elapsed time since the beginning of the experiment in minutes.

- b)** Use the above equation to calculate the temperature of the tea (in °C) after one quarter of an hour.
- c)** Use the above equation to calculate the number of minutes until the tea cools to 37°C.

<b>a)</b>	9 points	
<b>b)</b>	3 points	
<b>c)</b>	5 points	
<b>Ö.:</b>	17 points	



	number of question	score		
		maximum	awarded	total
Part II A	13.	12		
	14.	11		
	15.	13		
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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dátum

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javító tanár

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jegyző