

**ÉRETTSÉGI VIZSGA • 2021. május 4.**

**MATEMATIKA  
ANGOL NYELVEN**

**KÖZÉPSZINTŰ  
ÍRÁSBELI VIZSGA**

**2021. május 4. 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. It is known that  $3y + 9 = 2x$ . Calculate the value of  $y$  given that  $x = 123$ .

$y =$	2 points	
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2. Give the number of faces, edges and vertices for a square-based truncated pyramid.

Number of faces:	3 points	
Number of edges:		
Number of vertices:		

3. How many positive, two-digit, odd numbers do exist in the decimal (base-10) numeral system?

	2 points	
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4. Preparing a certain dish for four people requires 6 dl of milk. How many decilitres of milk would be needed if the same dish were prepared for seven people?

	2 points	
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5. Give the value of  $x$  if  $2^x = 2^0 \cdot 2^1 \cdot 2^2 \cdot 2^3 \cdot 2^4 \cdot 2^5 \cdot 2^6 \cdot 2^7 \cdot 2^8$ .

$x =$	2 points	
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6. One leg of a right triangle is 24 metres, the hypotenuse is 25 metres. How long, in metres, is the other leg?

	2 points	
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7. The first term of an arithmetic sequence is 2, the second term is 3.5.  
Which term of this sequences is equal to 80? Show your work.

	3 points	
	1 point	

8. A new web store had 3400 customers over the month of January, 2019. Each month after that, the number of customers increased by 7%.  
How many customers did the store have in January, 2020? Round your answer to the nearest hundred people. Explain your answer.

	3 points	
	1 point	

- 9.** Give the truth value (true or false) of the following statements:  
A: The diagonals of a rectangle bisect the angles of the rectangle.  
B: If one angle of a parallelogram is  $90^\circ$  then it is a rectangle.  
C: There exists a parallelogram with three acute angles.

A:		
B:	2 points	
C:		

- 10.** Select one of the first 25 positive integers at random. What is the probability that this number will be divisible by 4?

	2 points	
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**11.** Give one angle that is greater than  $180^\circ$  and its sine is 0.

	2 points	
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**12.** A basketball team scored 77, 60, 83, 73, and 90 points over the last five games. How many points should they score on their sixth game so that the overall average score for the 6 games is 75? Show your work.

	2 points	
	1 point	

		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	4	
	Question 8	4	
	Question 9	2	
	Question 10	2	
	Question 11	2	
	Question 12	3	
<b>TOTAL</b>		<b>30</b>	

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date

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examiner

	pontszáma <b>egész 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:**

- Ha a vizsgázó a II. írásbeli összetevő megoldását elkezdte, akkor ez a táblázat és az aláírási rész üresen marad!
- 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**

**KÖZÉPSZINTŰ  
ÍRÁSBELI VIZSGA**

**2021. május 4. 9:00**

**II.**

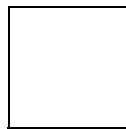
Időtartam: 169 perc

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.

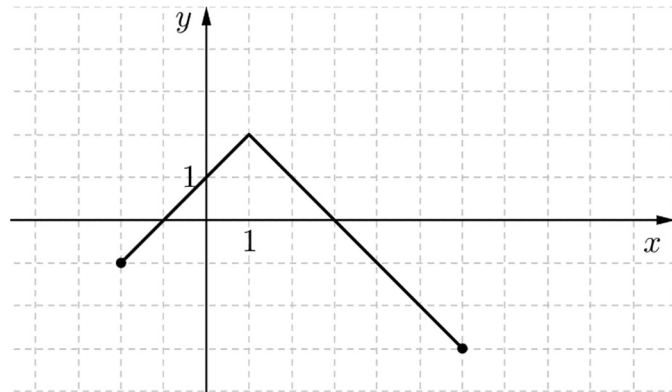


4. On solving the problems, you may use a calculator that cannot store and display textual information. You may also use any edition of the four-digit data tables. The use of any other electronic device or printed or written material is forbidden!
5. **Always write down the reasoning used to obtain the 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.** The diagram below shows the graph of the function  $f(x) = -|x - 1| + 2$  that is defined over the closed interval  $[-2; 6]$ .



- a)** Describe the function in terms of:
- zeroes;
  - place and value of maximum;
  - range.
- b)** The part of the function over the interval  $[1; 6]$  may also be given with the formula  $x \mapsto m \cdot x + b$ . Use the graph to determine the value of  $m$  and  $b$ .
- c)** For which real numbers  $x$  will the inequality  $f(x) < 1$  be true?

<b>a)</b>	6 points	
<b>b)</b>	3 points	
<b>c)</b>	4 points	
<b>T.:</b>	13 points	



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

**a)**  $\frac{1}{x-3} + \frac{1}{x-2} = \frac{5}{6}$ , where  $x \neq 2$  and  $x \neq 3$

**b)**  $7^{x+2} - 7^{x+1} = 2058$

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



**15.** There are 13 girls in a class of 32.

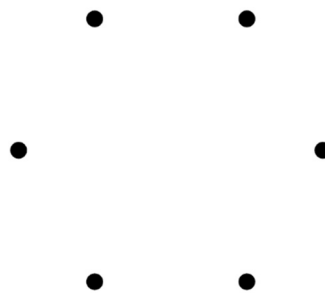
- a) Two members of the class are randomly selected. What is the probability that it will be two girls?

The school's movie club played 3 films in this academic year. Every one of the 32 members of the class had watched at least one of these films. The first film was watched by 11 students, the second was watched by 14 and 3 of these students watched both the first and the second films.

- b) How many students are there in the class who watched the third film only?

Anna, Bence, Cili, Dénes, Edit and Feri are all registered users on a new social media website. For two registered users to be *friends* they mutually have to tag each other. Of the 6 people, Anna is *not friends* with Bence but she is friends with all the others. Cili is also friends with Feri (besides Anna), and the only friend of Bence is Edit. Dénes, Edit and Feri are *not yet friends* of one another.

- c) Show the various *friends* relations of the 6 people on a graph and give the total number of "pairs" who are *not yet friends*.



a)	4 points	
b)	4 points	
c)	4 points	
<b>T.:</b>	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 2.**

- 16.** A metal works company is manufacturing steel containers. The shape of the container is a straight cone with a matching cylinder on top. The diameter of the base circle of both the cone and the cylinder is 80 cm, the height of the cone is 110 cm, the height of the cylinder is 120 cm.

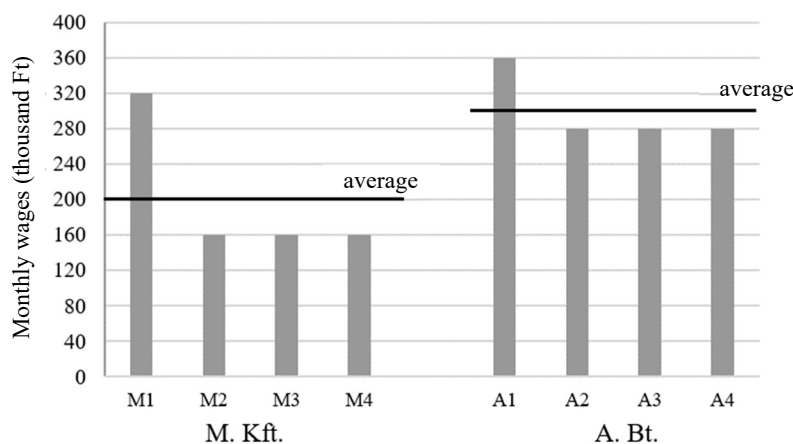


- a) What is the maximum capacity of the container in litres?
- b) What is the aperture (or vertical angle, at the tip) of the cone?

When production first started, the percentage of faulty containers was relatively high, the probability that a container would be faulty was 8%.

- c) Calculate the probability that no more than one out of 10 of these containers would be faulty.

Two metal processing companies have four workers each. The diagrams below show the monthly wages of these workers, as well as the (company) averages.



- d) Which company has a higher standard deviation for the wages?  
Explain your answer.

a)	5 points	
b)	4 points	
c)	5 points	
d)	3 points	
<b>T.:</b>	<b>17 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.**

- 17.** A sheet of A4 paper measures  $210 \times 297$  mm and weighs about 5 g. The density of paper is  $0.8 \text{ g/cm}^3$ .

- a)** Determine the thickness of an A4 sheet.  
Give your answer in millimetres. (density = mass/volume)

A (landscape style) photo has a side ratio of 2:3, the actual size is  $10 \times 15$  cm. An (also landscape style) A4-size copy is to be made of this photo. As the side ratio of the A4 sheet does not match that of the photo, one of two options must be chosen:

In case of a FIT the full photo will be visible on the copy but two blank strips of equal width will be seen above and below.

In case of a FILL there will be no blanks but two congruent rectangular parts will be missing from both the left and right edges of the original photo.



original



FIT



FILL

- b)** Determine the width of the blank strips in case of a FIT.  
**c)** What percentage of the area of the photo will be missing in case of a FILL?

A photography firm charges the following fees for  $10 \times 15$  cm photos:

1-50 photos – 59 Ft/photo

51-100 photos – 49 Ft/photo

more than 100 photos – 39 Ft/photo

Balázs ordered 51 photos of  $10 \times 15$  cm. Hajni ordered less but, in the end, still paid more than Balázs.

- d)** How many photos did Hajni order?

<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.**

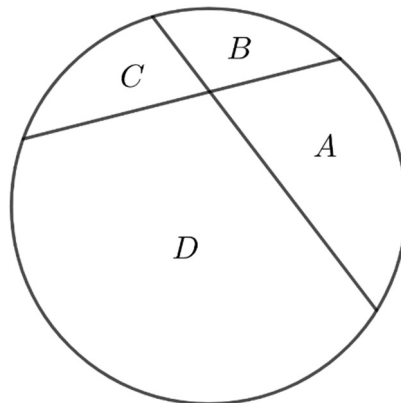
**18.** The equation of circle  $k$  in the coordinate-system is  $x^2 + y^2 - 2x - 4y - 15 = 0$ .

- a) Prove that the coordinates of the centre of this circle are  $(1; 2)$  and calculate the radius of the circle.

Point  $A$  is a point of the circle  $k$ . Its first coordinate is 3, the second coordinate is a positive number.

- b) Give the equation of the tangent line to circle  $k$  through point  $A$ .

The four regions of the disc shown below must be coloured such that no adjacent regions will be of the same colour (e.g. region  $A$  is adjacent to regions  $B$  and  $D$  but is not adjacent to region  $C$ ). The available colours are red, yellow, blue and green.



- c) How many different ways are there to colour the disc if three or more colours must be used?

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



	number of question	score		
		maximum	awarded	total
Part II A	13			
	14			
	15			
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

\_\_\_\_\_

dátum

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javító tanár

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jegyző