Név: ..... osztály:.....

ÉRETTSÉGI VIZSGA • 2022. május 3.

MATEMATIKA
ANGOL NYELVEN

KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA

minden vizsgázó számára

2022. május 3. 9:00

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.

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

1. Set $A = \{1; 2; 5; 6\}$ is given.
It is known that $A \cup B = \{1; 2; 3; 4; 5; 6\}$, and $A \cap B = \{1; 2\}$.
Give set B by listing its elements.

$B =$	2 points	

2. One side of a rectangle is 10 cm, the diagonal is 26 cm.
Calculate the length of the other side.

The length of the other side:	2 points	

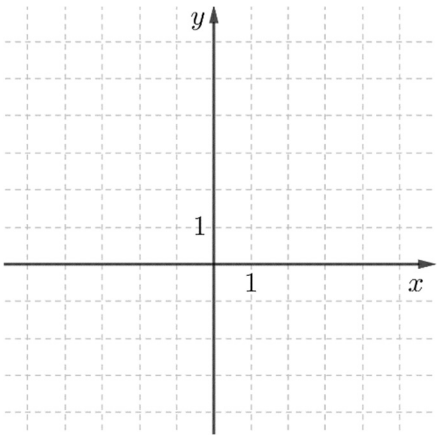
3. A certain number is smaller than its own opposite by 6. Which number is this?

	2 points	

4. What is the cost of 1 kg of cheese if 35 dkg costs 840 Ft?

1 kg of cheese costs: Ft	2 points	

5. The function $x \mapsto 2x - 1$ is defined over the closed interval [–1; 3].
Draw the graph of this function.



3 points	

6. Give five positive integers such that their mean is 4 and their (single) mode is 3.

Five suitable numbers:	2 points	

7. The functions below (*f, g, h, i*) are all defined over the set of real numbers. Select the ones that have a zero at 1.

$$f\colon\ x \mapsto 2x+1$$

$$g\colon\ x \mapsto (x-2)^2-1$$

$$h\colon\ x \mapsto |x-1|+1$$

$$i\colon\ x \mapsto (x-1)^2$$

	2 points	

8. Calculate the measure of one interior angle of a regular decagon (10 sides).

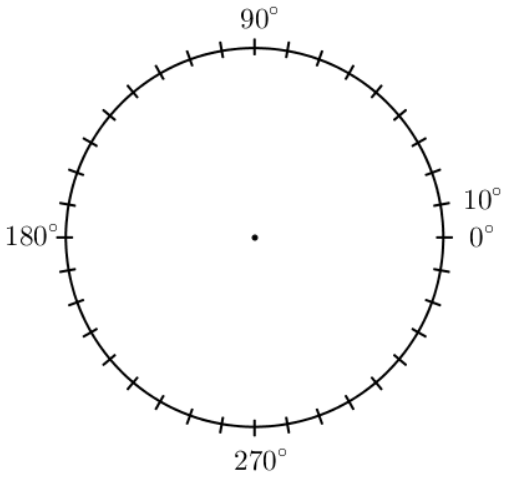
	2 points	

9. Solve the equation $3 \cdot 4^x = 96$ in the set of real numbers. Show your work.

	2 points	
$x =$	1 point	

10. The table below shows the results of a statistics test in a group of 18 students. Show the data on a pie chart.

Grade	Fail	Pass	Satisfactory	Good	Excellent
number of students	1	3	4	6	4

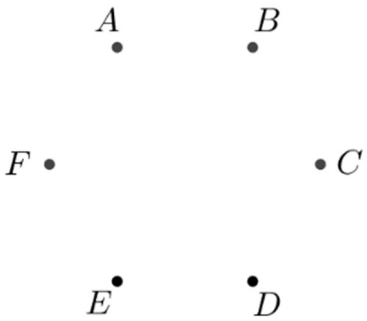


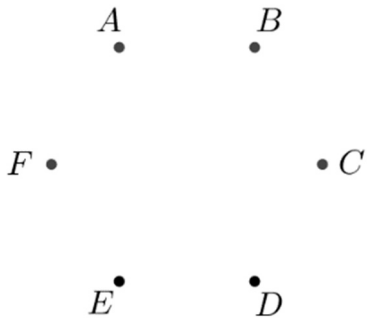
3 points	

11. List all four-digit natural numbers that are divisible by 6 and only use 1 and 2 as digits.

The numbers:	3 points	

12. In a company of 6 András has 5 acquaintances, Bori also has 5, Cili 3, Dezső 3, and Elemér has 2. How many of these people may be acquainted to Flóra, the sixth member of the group? Show all possible solutions as a graph.
(Acquaintances are mutual, the points in each graph are labelled with the initials of the group members. Any two points are to be connected with an edge if the appropriate people are acquaintances of one another.)





	2 points	
Possible number of Flóra's acquaintances:	2 points	

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

date examiner

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	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!

Név: ..... osztály:.....

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minden vizsgázó számára

2022. május 3. 9:00

II.

Időtartam: 169 perc

Pótlapok száma	
Tisztázati	
Piszkozati	

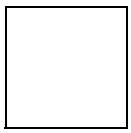
EMBERI ERŐFORRÁSOK MINISZTÉRIUMA

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

a) $\frac{3x+1}{2}+\frac{x-1}{3}=13$

b) $\sqrt{x-1}=7-x$

a)	5 points	
b)	6 points	
T.:	11 points	

14. **a)** The first term of a **geometric sequence** is 0.75, the fourth term is 6. Give the common ratio (quotient) of this sequence and calculate the sum of the first 20 terms.

b) The sum of the first three terms of an **arithmetic sequence** is 18. The sum of the third and the fourth terms is 28 more than the sum of the first and second terms. Give the first term of this sequence, the common difference and the sum of the first 20 terms.

a)	5 points	
b)	7 points	
T.:	12 points	

15. A set of boxes contains three cylindrical boxes made of thin metal sheets. The radius of the base of the largest box is 13 cm, its height is 18 cm. (Ignore the thickness of the walls.)

a) Give the volume of the largest box in litres.
Round your answer to one decimal place.

The manufacturing process of the box requires 18% more metal than the actual surface of the cylinder (because of the joints, the lip of the lid, and the waste).

b) How many square meters of metal would be needed to make 1000 of the largest type of box?

The price of each box is directly proportional to the area of the metal sheet needed to manufacture it. The smallest box requires 800 cm^2, the middle-sized requires 2000 cm^2 of metal. The price of these two boxes together is 2100 Ft.

c) What is the price of the smallest box and what is the price of the middle-sized box?

a)	4 points	
b)	5 points	
c)	4 points	
T.:	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 four points given in the coordinate system:
$A(0; 4)$, $B(1; 0)$, $C(6; 2)$ and $D(5; 6)$.

a) Give the equation of the line through points A and B.

b) Prove that the quadrilateral $ABCD$ is a parallelogram.

c) Calculate the measure of the interior angle at vertex B of the parallelogram $ABCD$.

The vertices of polygons are labelled with capital letters (e.g. $ABCD$, $EFGH$). The labelling is "correct" if, starting at one of the vertices, the letters follow one another in alphabetical order either clockwise or counter-clockwise.

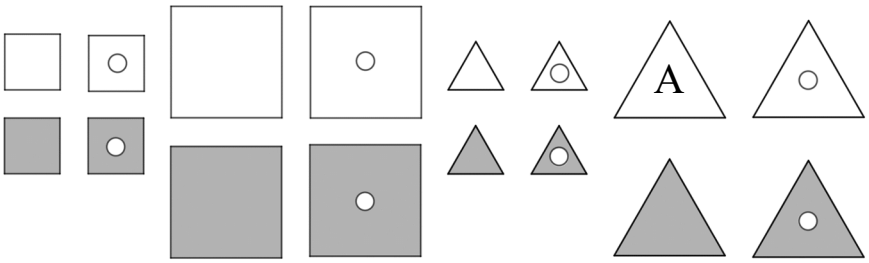
d) The four vertices of a quadrilateral are randomly labelled by the letters E, F, G and H. What is the probability that this random labelling will be correct?

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

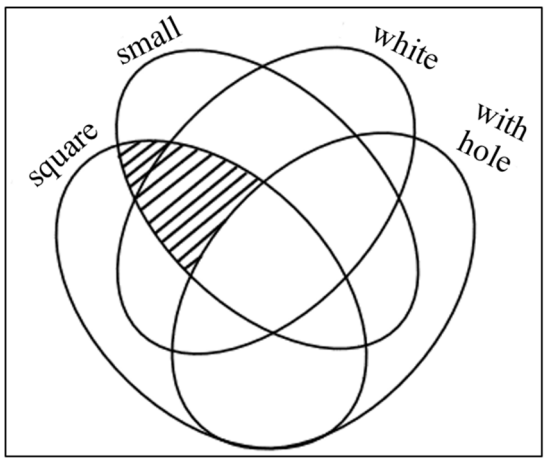
You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 2.

17. There are 16 pieces in a set of logic game and each piece is described by four different properties:

- they may be either large or small;
- either white or grey;
- either with or without a hole;
- either a square or a triangle.



One piece is marked with the letter A.



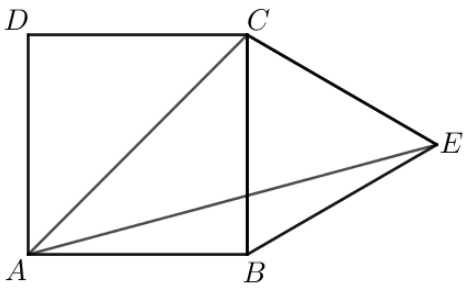
a) Place the piece marked A in the appropriate slot of the set diagram (write A in the correct pocket of the diagram).

b) **Circle** all pieces of the set above that would fit into the shaded region of the set diagram.

Pull two pieces randomly (without replacement).

c) What is the probability that both pieces are small triangles?

The length of the side of square *ABCD* is 3 cm. The regular triangle *BCE* is drawn outward, on side *BC* of the square, as shown in the diagram.



d) How many square centimetres is the area of triangle *ACE*?

e) Prove that the centre of the circumcircle of triangle *ACE* is point *B*.

a)	2 points	
b)	2 points	
c)	4 points	
d)	6 points	
e)	3 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 2.

18. Andrea and Balázs are playing *dice roulette*. One round in the game consists of rolling two fair dice at the same time. Before each round players may place bets on the five events listed on the game ticket by writing their bets into the appropriate columns of the ticket. The points used as bets will be deduced from the total score of each player. The ticket also lists the odds for each event, this number tells how many times the number of points placed as a bet will be returned to the player's score in case the particular event happens. Each player begins with a score of 100 points. The table below shows the game ticket used by Andrea. In the first round she gambled 10-10-10 points on three events. The numbers shown by the dice in this round were 1 and 4. Andrea lost her bet on event A but won 3·10 and 2·10 points on the other two. As she gambled 30 points but won 50 she finished round 1 with a total score of 120 points which is also what she begins round 2 with.

EVENT	odds	BETS		
		round 1	round 2	round 3
A: two even numbers are rolled	4	10		
B: an even and an odd number is rolled	3	0		
C: the sum of the two numbers is less than 6	3	10		
D: the product of the two numbers is even	2	10		
E: there will be 6 among the numbers rolled	3	0		
	total bets	30		

gain	50		
final score	120		
numbers rolled	1, 4		

a) In round 2 Andrea placed her bets on the same three events, 20 points each. All three won. What numbers had been rolled in round 2 and what was Andrea's final score after round 2?

b) In round 3 Andrea placed 10 points on each of the first 3 events but lost on all three of them. What numbers had been rolled in round 3?

c) In one of the rounds Balázs placed bets on events A, D and E, 70 points in total. He won on all three of them. His bet on event E was twice as much as it was on event A. How many points did Balázs place on event A if his **gain** was 200 points?

d) On a different day they were playing with 3 fair dice of different colour. A new event was also introduce:

At least one 5 is rolled.

Calculate the probability of this event.

a)	4 points	
b)	3 points	
c)	6 points	
d)	4 points	
T.:	17 points	

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

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

dátum

dátum

javító tanár

jegyző