

ÉRETTSÉGI VIZSGA • 2018. május 8.

**MATEMATIKA
ANGOL NYELVEN**

**KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA**

2018. május 8. 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 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 fifth term of an arithmetic progression is 7, the eighth term is 1.
Give the common difference of this progression.

The common difference:	2 points	
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2. Consider all subsets of the set $A = \{P; Q; R; S\}$ that contain exactly two elements.
How many such subsets are there?

The number of subsets with two elements:	2 points	
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3. Find the greatest common divisor of $2^3 \cdot 3^2 \cdot 5$ and $2 \cdot 3^4$.

The greatest common divisor:	2 points	
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4. Determine the truth value (true or false) of the following statements:

- A: The measure of one interior angle of a regular octagon (8 sides) is 135° .
- B: The point of intersection of the angle bisectors of a triangle is the centre of the circumscribed circle of the triangle.
- C: There exists a trapezium whose angles are all right angles.

A: B: C:	2 points	
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5. The graph of a linear function intersects the x -axis at (-2) and the y -axis at 6 . Give the gradient (slope) of this graph.

The gradient:	2 points	
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6. The initial price of a refrigerator has been 112 000 forints, but it is on sale now at a discount price of 95 200 forints.
By what percentage is the discount price lower than the initial price? Show your work.

	2 points	
It is % lower.	1 point	

7. Solve the equation $2 \cdot 3^{x-4} = 54$ in the set of real numbers. Show your work.

	2 points	
$x =$	1 point	

8. Determine the value of the expression $\frac{a^2b + ab^2}{a + b}$ when $a = \sqrt{2}$ and $b = \sqrt{8}$.

The value of the expression:	2 points	
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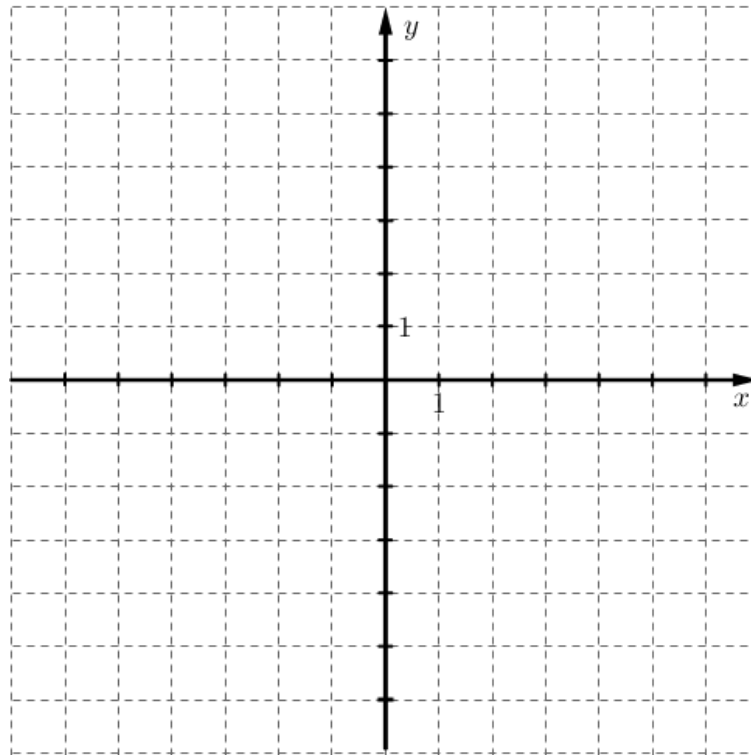
9. András deposits 300 000 forints in a bank at an annual interest rate of 2% for five years. How much money will András have in the bank at the end of the five-year period?

	2 points	
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10. Given that $\log_8 x = \log_2 32$ is it true that $x > 32\,000$? Explain your answer.

	2 points	
	1 point	

11. Draw the graph of a strictly monotone decreasing function whose domain is $[-5; 3]$ and range is $[1; 5]$.



3 points	
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12. Roll a fair dice twice and record the results (in the order of rolls), thereby obtaining a two-digit number.
What is the probability that the number obtained will be divisible by 7?
Show your work.

	3 points	
The probability:	1 point	

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

_____ date

_____ examiner

	pontszáma egész számra kerekítve	
	elért	programba beírt
I. rész		

_____ dátum

_____ dátum

_____ javító tanár

_____ 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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II.

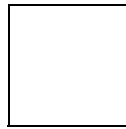
Időtartam: 169 perc

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 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) $\frac{1-2(x+1)}{5} + \frac{18-x}{11} = -2$

b) $\sqrt{7-x} = x+5$

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

- 14.** On a lottery ticket players have to mark five numbers out of the numbers 1, 2, 3, ..., 90. At the weekly lottery show, the five winning numbers for that week are publicly drawn.

For this week, Áron bought one lottery ticket. Last week the numbers 6, 9, and 54 were among the winners. This week Áron would like to mark numbers that are multiples of neither 6 nor 9.

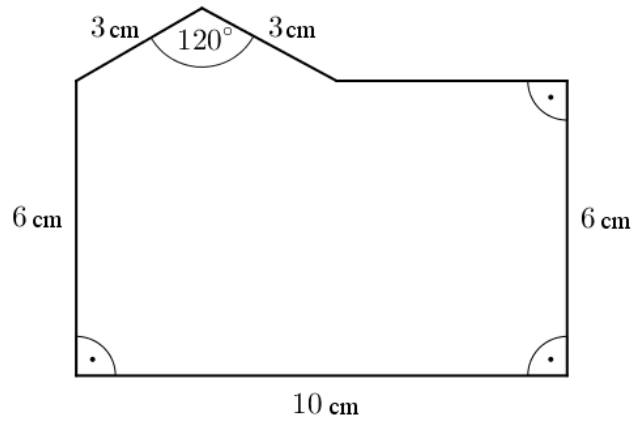
- a)** How many numbers can Áron choose from while filling in his ticket?

Áron watches the lottery show together with his 5-year-old daughter, Panni. Panni would like all the winning numbers to be at least 5.

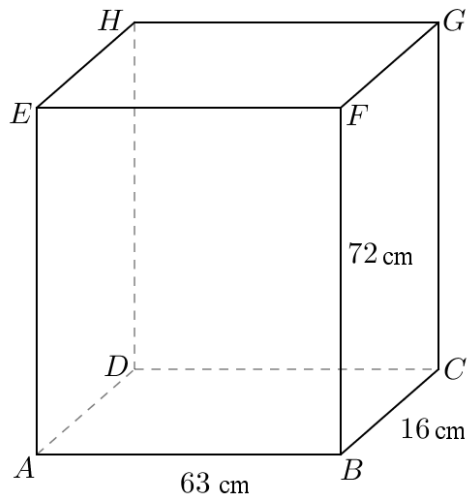
- b)** What is the probability that Panni will get her wish?

a)	5 points	
b)	5 points	
T:	10 points	

15. a) Calculate the perimeter and area of the 6-sided polygon shown in the diagram.



- b) The lengths of the edges of the cuboid shown below are $AB = 63$ cm, $BC = 16$ cm, $BF = 72$ cm. Calculate the angle between the solid diagonal CE and the face $ABCD$.



a)	10 points	
b)	4 points	
T:	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.** Six players of a football team are playing one-on-one football tennis games as a warm-up exercise. The table below shows how many opponents each player has met so far. (No player has played against the same opponent more than once.)

Player	A	B	C	D	E	F
Number of games	2	5	2	2	5	

- a)** Is it possible that player F has played against 3 opponents?

At the beginning of the football game the average height of the 11 players on the field was 186 cm. After a substitution, the average height changed to 188 cm.

- b)** How many centimetres taller is the new player than the one he substituted?

During the game a player kicked the ball and nobody else touched it until it hit the ground. The height of the ball over the field is described by the function $h(t) = -5t^2 + 15t$ where t is the time passed since the ball has been kicked. (Height is measured in metres, time in seconds.)

- c)** How high above the field was the ball 1 s after it had been kicked?
d) For how long was the ball in the air?
e) How high above the field was the ball at the highest point of its trajectory?

a)	3 points	
b)	4 points	
c)	2 points	
d)	4 points	
e)	4 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. Some graduating students have been given a coordinate-geometry practice test. The first part of the test contains six multiple-choice questions. Three possible solutions are given for each question, exactly one of which is correct.

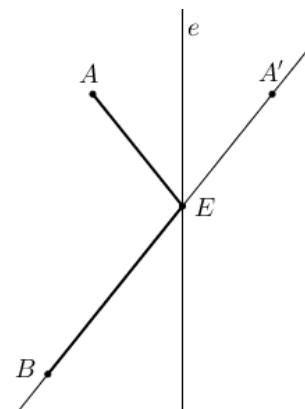
- a) In how many different ways can one solve this part of the test assuming that exactly five out of the six questions will be correctly answered? (One out of the three possible answers is marked for each question.)

The second part of the test contains eight problems but only two of those must be solved. Three out of the eight problems require the ability to find the point of intersection of two lines. Eszter picks two questions out of the eight at random.

- b) Calculate the probability that at least one of the two questions Eszter has picked requires the ability to find the point of intersection of two lines.

One of the problems given in part two is the following:

“Given in a coordinate system are line e and points A and B . Reflect point A about line e , the image is A' . Connect A' to B . The point of intersection of the lines $A'B$ and e is point E .
Let the points be $A(-5; 36)$ and $B(-9; 11)$ and the equation of the line be $x = 3$. Give the coordinates of point E .”



- c) What did Eszter give for the first and second coordinates of point E assuming she gave the correct answer?

a)	3 points	
b)	6 points	
c)	8 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.** A farming company is using forage harvester machines to harvest grass on their field. Work begins at 7 o'clock in the morning with a machine that harvests the whole field in 8 hours. At 10 o'clock clouds start gathering and so a second, identical machine is also put to work. Both machines keep working continuously.

a) By what time will the pair of machines finish harvesting the whole field?

Dry grass (hay) is compressed into uniform, cylindrical bales which are then wrapped around in plastic foil. Both the diameter and the height of the bales is 1.2 m. The hay baler machine compresses about 160 kg of hay into 1 m^3 .

b) How many kilograms does one bale weigh?
Give your answer rounded to the nearest 10 kg.

A quality controller checks the hay baler machine by taking samples. The controller randomly selects 10 bales and measures the diameter of their base circles. To pass the quality check, the average of the sampled values must be within the interval [118 cm, 122 cm] and the standard deviation must not be greater than 4 cm.

The controller measured the following diameters:

No. of bale	1	2	3	4	5	6	7	8	9	10
diameter (cm)	115	122	119	114	116	120	124	116	118	126

c) Decide whether the baler machine will pass the quality check.

a)	6 points	
b)	5 points	
c)	6 points	
T:	17 points	

	number of question	score		
		maximum	awarded	total
Part II A	13	12		
	14	10		
	15	14		
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

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

dátum

dátum

javító tanár

jegyző