

ÉRETTSÉGI VIZSGA • 2020. október 20.

**MATEMATIKA
ANGOL NYELVEN**

**KÖZÉPSZINTŰ
ÍRÁSBELI VIZSGA**

2020. október 20. 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 following two sets are given:

$$A = \{1; 3; 6; 10; 15\};$$

$$B = \{1; 4; 10; 20\}.$$

Give the sets $A \cap B$ and $A \setminus B$ by listing their elements.

$A \cap B =$	1 point	
$A \setminus B =$	1 point	

2. Anna goes running on a 200-metre long circular track for five days. On the first day she runs 5 laps. Starting from the second day, she is running 1 more lap each day than she did on the day before.
What is the total distance (in metres) run by Anna during these five days?

She ran a total metres.	2 points	
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3. What digit should be written in place of x so that the four-digit number $\overline{202x}$ is divisible by 12?

$x =$	2 points	
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4. Which of the following numbers is equal to two times 2^{100} ?

2^{101}

2^{102}

2^{200}

4^{100}

	2 points	
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5. On a certain week the following five lottery numbers were drawn: 16, 24, 36, 54, 81.
Determine the truth value of the following statements (true or false).

A: All of these five numbers are divisible by 3.

B: Three of these five numbers are square numbers.

C: These five numbers may be considered as the first five terms of a geometric sequence.

A:	2 points	
B:		
C:		

6. The function $f(x) = 10^{\frac{x}{4}}$ is defined over the set of real numbers.

a) Determine the value of $f(12)$.

b) Determine the real number x for which $f(x) = 100$.

a) $f(12) =$	1 point	
b) $x =$	2 points	

7. A certain product cost 15 000 Ft. At the end of October the price of this product had been raised by 25%. What is the percentage of “discount” at the end of November if the price is dropped back to 15 000 Ft again?
Show your work.

	2 points	
The discount percentage is %.	1 point	

8. The length of the edge of a cube is b . The surface area of this cube is 13.5 cm^2 .
How much is the surface area of a cube the edge of which is $2b$ long?
Show your work.

	2 points	
The surface area is:	1 point	

9. How many different 6-digit numbers may be formed with two 2-s and four 4-s?

	2 points	
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10. The function $x \mapsto x^2 - 1$ is defined over the interval $[-2; 2]$.

- a) Determine the range of the function.
- b) Give the zeroes of the function.

a)	2 points	
b)	2 points	

- 11.** Four friends measured how long (in minutes) it took for each of them to get to the school on Tuesday morning. Here are the results: 38, 30, 26, 26.
Calculate the mean and the standard deviation of these time intervals.

The mean:	1 point	
The standard deviation:	2 points	

- 12.** What is the probability that two fair dice, rolled at the same time, will show two different numbers?

	2 points	
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		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	3	
	Question 9	2	
	Question 10	4	
	Question 11	3	
	Question 12	2	
TOTAL		30	

date

examiner

	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!

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II.

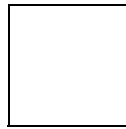
Időtartam: 169 perc

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.** a) I thought of a number. I subtracted 5 from half of this number, multiplied the difference by 4 then added 8 to the result. The number I got as a result was the same as the original number I thought of. What number did I think of?
- b) The 10th term of an arithmetic sequence is 18, the 30th term is 48. Give the first term and the common difference of this sequence.

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

14. The length of leg BC of the right triangle ABC is 40 cm, the length of hypotenuse AB is 41 cm.

- a) Calculate the area of the triangle. Give your answer in dm^2 .
- b) Calculate the acute angles of the triangle.
- c) Calculate the perimeter of the circumcircle of the triangle. Round your answer to the nearest cm.

a)	5 points	
b)	3 points	
c)	4 points	
T:	12 points	

- 15.** A climate change scientist researches the changes in the global annual mean temperatures. He has the annual mean temperature data of Earth for each year, starting with 1900. The scientist models the changes of the annual mean temperatures with the function

$$f(x) = 0.0001x^2 - 0.0063x + 15.2.$$

In this formula x represents the number of years passed **since 1900**, while $f(x)$ is the annual mean temperature for that particular year in °C ($0 \leq x \leq 119$).

- a)** Use the model to calculate how much higher the annual mean temperature was in 2018 than it was in 1998.
- b)** In which year was the annual mean temperature 15.42 °C?

Based on data collected after the year 2000 the scientist proposes that the annual mean temperatures in the decades following 2018 may be predicted using the function

$$g(t) = 15.92 \cdot 1.002^t.$$

In this formula t represents the number of years passed since 2018, while $g(t)$ is the predicted mean temperature for that particular year in °C ($0 \leq t$).

- c)** Use this model to estimate the year in which the annual mean temperature will be 16.7 °C.

a)	4 points	
b)	5 points	
c)	5 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. The length of Earth's orbit around the Sun is about 939 million km. It takes about 365.25 days for Earth to travel one full "lap" around the Sun.

- a) Calculate the average speed in km/h while the Earth travels one full "lap" around the Sun.

The planet furthest from the Sun in our solar system is Neptune, it is about 4.2 light-hour away from the Sun. A light-hour is the distance travelled by light in one hour.

- b) Calculate the distance of Neptune from the Sun in kilometres. Give your answer in scientific form. (Light travels about 300 000 km in one second.)

The planets of our solar system are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. A question in a geography test asks students to list the planets in order of their distance from the Sun. Judit knows for sure that Earth is third in line and Neptune is the last. She writes these in their correct slots. She also remembers that closest to the Sun are Mercury and Venus but she does not remember the exact order so, for these two, she only guesses. She fills in the last four slots randomly with the names of the remaining four planets.

- c) Calculate the probability that Judit lists the planets in the correct order.

The names of each of the eight planets are written on small paper cards and placed in a hat. A card is then randomly drawn from the hat and then a second card is drawn.

- d) Consider two cases: in one of them the card drawn first is replaced into the hat before a second card is drawn while in the other case it is not replaced.

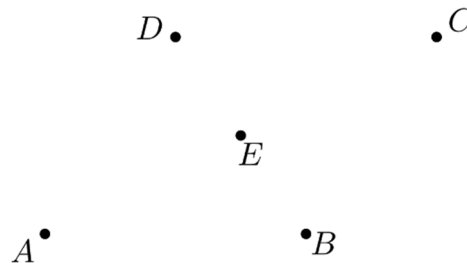
Now consider the probability that the name Earth appears at least once on the two cards drawn.

In which case is this probability greater: when the first card is replaced or when it is not replaced?

a)	3 points	
b)	3 points	
c)	4 points	
d)	7 points	
T:	17 points	

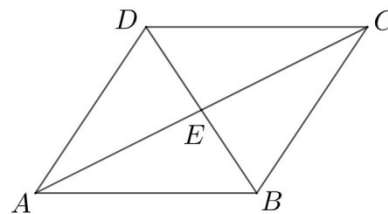
You are required to solve any two out of the problems 16 to 18. Write the number of the problem NOT selected in the blank square on page 2.

17. Consider the points A, B, C, D and E as vertices of a certain graph.



- Draw edges into the diagram above such that the degree of each vertex is 2 or 3.
- Is it possible to draw a graph on 5 vertices such that the degree of each vertex is exactly 3?

Points A, B, C and D form the vertices of a parallelogram, point E is the intersection of the diagonals.



- Express vector \overrightarrow{AB} in terms of vectors \overrightarrow{DA} and \overrightarrow{DE} .

A certain parallelogram $ABCD$ is placed in a coordinate system. The equation of line AB is $2x - 5y = -4$. The equation of line AD is $3x - 2y = -6$. The coordinates of point C are $(5; 5)$, the first coordinate of point B is 3.

- Give the coordinates of vertices A, B and D .

a)	2 points	
b)	3 points	
c)	3 points	
d)	9 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 nail can be divided into three basic solids of revolution. The head of the nail is a truncated cone such that the diameter of the base is 5 mm, the diameter of the top is 2 mm and the height is 1 mm. The round middle part is a cylinder, 25 mm long, and its diameter is also 2 mm. The point of the nail is a cone the height of which is 2.5 mm and the diameter of the base is 2 mm.



- a) What is the full length of this nail?

A hardware store sells 10 dkg of these nails in a pack.

- b) About how many nails will be in the pack, given that the density of the metal the nails are made of is 7.8 g/cm^3 ? (Mass = density \times volume.)

In a survey 50 people were asked to buy a pack (about 10 dkg) of these nails and then count the number of nails in the pack. The results are shown in the following table:

number of nails	frequency	number of nails	frequency
120-124	1	140-144	10
125-129	2	145-149	7
130-134	6	150-154	5
135-139	17	155-159	2

- c) Draw a bar chart based on the above data.
- d) Calculate the median and the mean of the 50 data. Use the class average for each category in both cases. (The class average is calculated from the top and bottom boundaries for each class.)

a)	2 points	
b)	8 points	
c)	3 points	
d)	4 points	
T:	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		
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