MATEMATIKA
ANGOL NYELVEN
MATHEMATICS

EMELT SZINTŰ
ÍRÁSBELI VIZSGA
HIGHER LEVEL
WRITTEN EXAMINATION

Az írásbeli vizsga időtartama: 240 perc
Time allowed for the examination: 240 minutes

Pótlapok száma / Number of extra sheets	
Tisztázati / Final version	
Piszkozati / Draft	

OKTATÁSI MINISZTÉRIUM
MINISTRY OF EDUCATION

Instructions to candidates

- The time allowed for this examination paper is 240 minutes. When that time is over, you will have to stop working.

- You may solve the problems in any order.

- In Section **II**, you are only required to solve four out of the five problems. **When you have finished the examination, write in the square below the number of the problem NOT selected.** *If it is not clear* for the examiner marking the paper which problem you do not want to be assessed, then problem 9 will not be assessed!

- In solving the problems, you are allowed to use a calculator that cannot store and display verbal information. You are also allowed to use four-digit data tables. The use of any other electronic devices or printed material is forbidden!

- Always write down the reasoning used in obtaining the answers, since a large part of the attainable points will be awarded for that.

- Make sure that the calculations of intermediate results are also possible to follow.

- In solving the problems, theorems studied and given a name in class (e.g. the Pythagorean theorem or the altitude theorem) do not need to be stated precisely. It is enough to refer to them by the name, *but their applicability needs to be briefly explained.* Reference to other theorems will only be awarded full mark if the theorem and all its conditions are stated correctly (proof is not required), and the applicability of the theorem to the given problem is explained.

- Always state the final result (the answer to the question of the problem) in words, too.

- Write in pen. Diagrams are also allowed to be drawn in pencil. If you cancel any solution or part of a solution by crossing it over, it will not be assessed.

- Only one solution to each problem will be assessed.

- Please do not write anything in the grey rectangles!

I.

1.   The equations of the sides of a triangle *ABC* are

$AB: \quad y = 0,$

$BC: \quad x + 10y = 20,$

$CA: \quad y = \dfrac{1}{2}x - 4.$

a) Calculate the coordinates of the vertices of the triangle.
b) Calculate the interior angle at vertex *B* of the triangle.

a)	7 points	
b)	4 points	

2. **a)** Decide whether each of the following four statements is true or false. Hence fill in the given table.
A: A complete graph with 6 vertices has 15 edges.
B: If a complete graph has an even number of edges then the number of its vertices is also even.
C: If there is no circuit in a graph with 51 vertices, it can have a maximum of 50 edges.
D: There is no graph with 6 vertices in which the sum of the orders of the vertices is 11.

A	B	C	D

b) In case somebody, who has not heard of graphs yet, fills in the given table what is the probability that all her/his four answers are going to be correct?

c) Negate the following statement:
"There is no such love that would never end." (*Translated from a Hungarian folk song*)

d) Formulate a word problem whose solution is obtained by calculating $\binom{17}{2}$.

a)	4 points	
b)	3 points	
c)	3 points	
d)	3 points	

3. The sum of the first three terms of an increasing arithmetic progression is 60. If we increase the first term by 64 and leave the other two terms unchanged, we will get the first three terms of a geometric progression. What are the first three terms of each sequence?
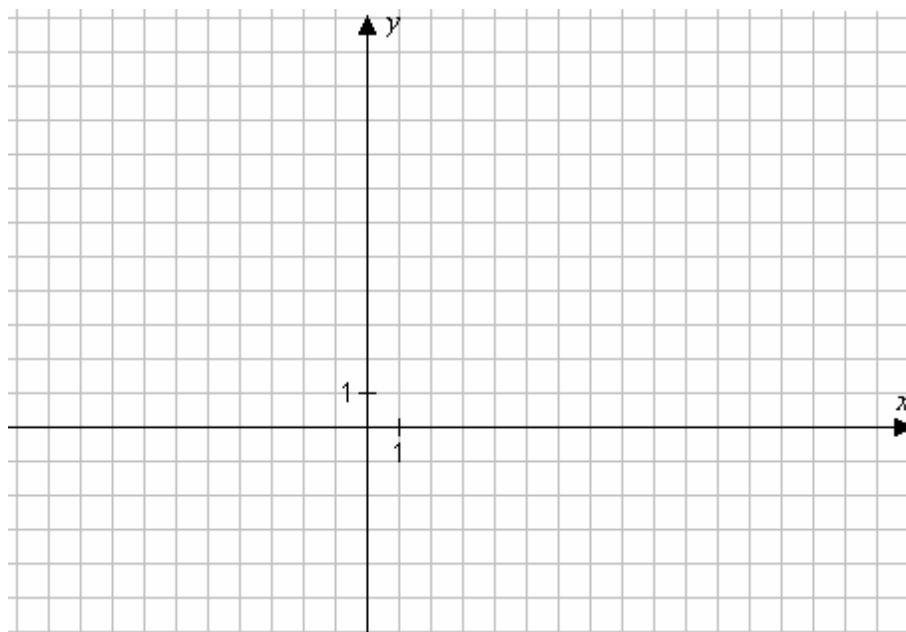
13 points	

4. **a)** Graph the function defined on the interval $[0;6]$, by the following rule of

assignment: $x \mapsto \dfrac{1}{2}|x-4|+3$.

b) Find the range of the function.

c) Rotate the graph of the function restricted to the interval $[0;4]$ around the *x*-axis. Calculate the volume of the resulting solid of revolution.

a)	4 points	
b)	2 points	
c)	8 points	

II.

You are required to solve any four out of the problems 5 to 9. Write the number of the problem NOT selected in the blank square on page 2.

5. Out of the 18 restaurants of a town, 11 serve breakfast, 11 serve vegetarian meals and 10 provide table service. All the 18 restaurants provide at least one of the three services listed. Five restaurants serve breakfast but no vegetarian meals. Five of the restaurants providing breakfast also provide table service. There is only one restaurant that provides all three types of services.

a) How many restaurants provide vegetarian meals but no breakfast?

b) How many restaurants serve vegetarian meals?

c) In the restaurant *Rooster* customers are invited to participate in a draw after paying the bill. They are given two boxes. Both boxes contain balls with the names of the restaurants of the town on each. Box *A* contains the name of each restaurant exactly once. Box *B* contains the names of those restaurants – exactly once each − that do NOT have table service. Customers can pick one ball from one of the boxes. If breakfast is served in the particular restaurant drawn, the customer wins free breakfast for a week. If breakfast is not served there, the customer does not win anything. For which box is there a greater chance of winning?

a)	5 points	
b)	6 points	
c)	5 points	

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6. Consider the function $f(x) = (p - 3.5)x^2 + 2(p - 2)x + 6$, defined on the set of real numbers, where p is an arbitrary real parameter.

a) Show that $x = -2$ is a zero of the function for all real values of p.

b) For what values of p will the other zero of the given function be greater than 1?

a)	2 points	
b)	14 points	

You are required to solve any four out of the problems 5 to 9. Write the number of the problem NOT selected in the blank square on page 2.

7.   Solve the following equation on the set of real numbers.

$$\sqrt{\sin^2 x - 4\sin x + 4} + \sqrt{\sin^2 x + 4\sin x + 4} = \sqrt{\sin^2 x + 7\sin x + 12.25}$$

16 points	

You are required to solve any four out of the problems 5 to 9. Write the number of the problem NOT selected in the blank square on page 2.

8. The following table contains the distribution of the numbers of people employed in the various sectors in a country. Data are rounded to the nearest thousand.

	Sectors	Year 2003. *(thousand)*	Year 2004. *(thousand)*
Employed	Agriculture	1020	
	Industry	1870	1926
	Services	5015	
Unemployed		595	
Active population		8500	

In the year 2004,
- the active population increased by 0.3 percent compared to 2003,
- the unemployment rate within the active population remained the same,
- the number of people employed in the service sector increased by 2%.

a) Calculate the missing data of the table (rounded to the nearest thousand).

b) Represent the distribution of people employed in the different sectors in 2003 on a pie chart.

c) By what percentage did the number of people employed in agriculture change between 2003 and 2004? Did it increase or decrease?

a)	7 points	
b)	5 points	
c)	4 points	
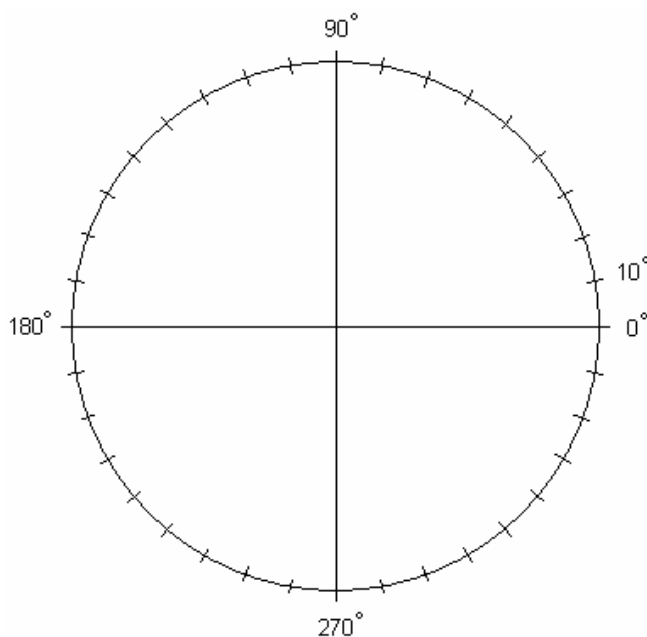
You are required to solve any four out of the problems 5 to 9. Write the number of the problem NOT selected in the blank square on page 2.

9. The sides of a triangle *ABC* are *AB* = 42, *BC* = 40 and *CA* = 26. Inscribe a rectangle in the triangle, such that one side of the rectangle lies on side *AB* of the triangle and the remaining two vertices are on sides *CA* and *BC*. Find the inscribed rectangle with the largest possible area. How long are the sides of this rectangle?

16 points	

	number of problem	points awarded	sub total	maximum number of points
Section I.	1.			11
	2.			13
	3.			13
	4.			14
Section II.				16
				16
				16
				16
	← problem not attempted			
TOTAL				**115**
grade (percentage)				

examiner

	number of problem (feladat száma)	score attained (elért pontszám)	score input for program (programba beírt pontszám)
Section I. (I. rész)	1.		
	2.		
	3.		
	4.		
Section II. (II. rész)			

examiner
(javító tanár)

registrar
(jegyző)