In His Name

Al-Mahdi school **Math Department**

Grade: 10 **Midyear- (08 – 09)** **Duration : 150 min**

The plane, when needed, is referred to an orthonormal system (O; $\vec{i}$; $\vec{j}$)

Question I: (4 points)

In the table below, **only one** of the proposed answers to each question is correct, write down the number of each question and give, **with justification**, the answer corresponding to it.

№	Questions	Proposed answers		
		A	B	C
1°	The principal determination of the angle $\alpha = \frac{23\pi}{4}$ is :	$\frac{\pi}{4}$	$-\frac{\pi}{4}$	$\frac{3\pi}{4}$
2°	If $x \in]-\infty;2[\cup]1;7[$ then:	$x \le 7$	$2 < x < 7$	$1 < x < 2$
3°	$\sin^2 91^\circ + \sin^2 1^\circ =$	0	1	$\sin^2 92^\circ$
4°	The roots of the equation $x^3 - x^2 - x + 1 = 0$ are:	0 and1	-1, 0 and1	-1 and 1

Question II: (3.5 points)

Let $E = \{m, a, t, h, s\}$; $A = \{m, h, s\}$ and $B = \{s\}$ are two subsets of E.

1) Find $A \cap \overline{B}$.

2) How many **3 letter words** can we form from the elements of E if:

a- The letters are different.

b- Even word starts with the letter "a", repetition is not allowed.

(**Remark:** a world could not have meaning)

Question III: (5 points)

Remark: All parts of this problem are independent.

1) Knowing that: $\tan x = \frac{3}{4}$ and $\pi < x < \frac{3\pi}{2}$.

Prove that $E = 5\sin x - 9\cot x$ is an integer.

2) Simplify: $A = \sin\left(\frac{9\pi}{2} - x\right) - \cos(6\pi - x) + \tan\frac{\pi}{4}\sin\left(\frac{-5\pi}{4}\right)$.

3) Prove that: $\frac{1}{1-\sin x} + \frac{1}{1+\sin x} = 2 + 2\tan^2 x$.

Question IV: (5 points)

Remark: The two parts of this problem are independent.

1) Solve in **R** : $\begin{cases} \frac{x^4+1}{-3x+2} \\ 9(x-1)^2 \le (2x+1)^2 \end{cases}$

2) Consider the straight lines $(d): x + y - 1 = 0$ *and* $(d'): x - y + 3 = 0$.

a- Trace (d) and (d').

b- Place, on the figure the points $A(-1,2), B(-3,0)$ *and* $C(1,0)$.

c- Form the system of inequalities, whose solution is the region inside triangle ABC.

Question V: (3.5 points)

Consider the two straight line: $(D_1): \begin{cases} x = 2t + 1 \\ y = -t + 3 \end{cases}$ and $(D_2): 3x + y - 1 = 0$.

1) Write a Cartesian equation of the line (D_1).

2) Write a system of parametric equations of the straight line passing through A (1; 2) and parallel to (D_2).

3) Let the straight line (D_m): $(m-1)x + (2m-1)y + 3 = 0$.

Determine the value of m such that (D_m) and (D_2) are parallel.

Question VI: (4 points)

ABC is a triangle. The points P, Q and G are defined by:

$\overrightarrow{PB} + 2\overrightarrow{PC} = \vec{0}$; $3\overrightarrow{QA} + 2\overrightarrow{QC} = \vec{0}$; $-\overrightarrow{GA} + 2\overrightarrow{GB} + 3\overrightarrow{GC} = \vec{0}$.

1) Prove that $\overrightarrow{PC} = \frac{1}{3}\overrightarrow{BC}$; $\overrightarrow{AQ} = \frac{2}{5}\overrightarrow{AC}$.

2) Construct P and Q.

3) Let M and M' be two points of plane defined by: $\overrightarrow{MM'} = -\overrightarrow{MA} + 2\overrightarrow{MB} + 3\overrightarrow{MC}$.

Prove that G, M and M' are collinear.

Question VII: (5 points)

ADCB is a square. Designate by I the midpoint of [AB] and by E the point defined by: $\overrightarrow{IE} = \frac{1}{3}\overrightarrow{ID}$.

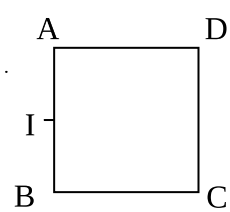
Consider the system $(B; \overrightarrow{BC}; \overrightarrow{BA})$ of the plane.

1) Find the coordinates of the points A, B, C, D and I.

2) Show that the coordinates of E are $\left(\frac{1}{3}; \frac{2}{3}\right)$.

3) Verify that E is the center of gravity of the triangle ABD.

4) Prove that A, E and C are collinear.



Good Work