وزارة التربية والتعليم العالي المديريّة العامّة للتربية دائرة الامتحانات الرسميّة	امتحانات الشهادة الثانوية العامة فرع علوم الحياة	دورة العام ٢٠١٩ الاستثنائيّة الاثنين ٢٩ تموز ٢٠١٩

عدد المسائل: اربع	مسابقة في مادة الرياضيات المدة: ساعتان	الاسم: الرقم:

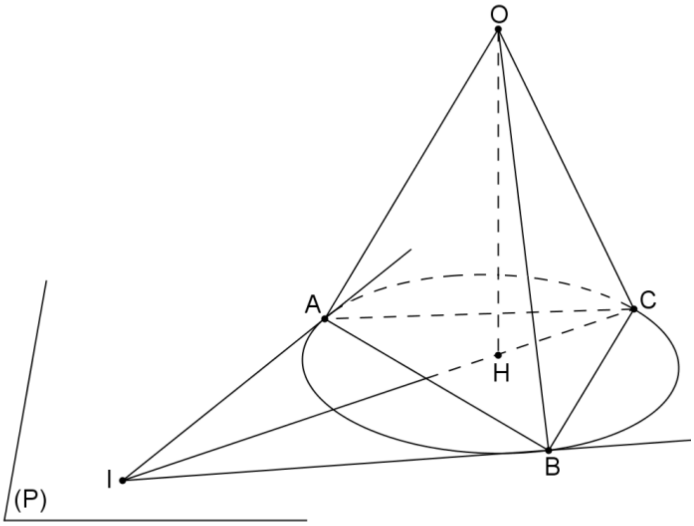
ملاحظة: - يسمح باستعمال آلة حاسبة غير قابلة للبرمجة او اختزان المعلومات او رسم البيانات.
- يستطيع المرشّح الإجابة بالترتيب الذي يناسبه (دون الالتزام بترتيب المسائل الواردة في المسابقة).

I- (4 points)

In the space referred to a direct orthonormal system $\left(O;\vec{i},\vec{j},\vec{k}\right)$, consider the points A(6 , 0 , 0), B(0 , 6 , 0) and C(0 , 0 , 6) .

Let (Ω) be the circle circumscribed about triangle ABC.

1) Show that triangle ABC is equilateral.
2) Write a cartesian equation of the plane (P) determined by the points A, B and C.
3) a- Show that point H(2 , 2 , 2) is the orthogonal projection of point O on (P).
   b- Verify that H is the center of (Ω).
   c- Show that the volume of tetrahedron OABC is triple the volume of tetrahedron OAHB.



4) Consider the line (D) with parametric equations: $\begin{cases} x = 6 \\ y = -m \\ z = m \end{cases}$; where $m \in \mathbb{R}$
   a- Show that (D) is tangent to (Ω) at A.
   b- Let (D') be the tangent to (Ω) at B, and I the point of intersection of (D) and (D').
   Show that I, H and C are collinear.

II- (4 points)

In the complex plane referred to a direct orthonormal system $\left(O;\vec{u},\vec{v}\right)$, consider the points A and B with affixes 1 and –2 respectively .

M and M' are two points with respective affixes z and z' such that $z' = \dfrac{\overline{z}+2}{\overline{z}}$ with $z \neq 0$.

1) Write z in exponential form in the case where $z' = 1+i$.
2) a- Show that $OM' = \dfrac{BM}{OM}$.
   b- If $|z'| = 1$, show that M is on a straight line to be determined.
3) a- For all $z \neq 0$, show that $\overline{z}(z'-1) = 2$.
   b- For all $z \neq 0$, verify that $\arg(z'-1) = \arg(z) + 2k\pi$ with $k \in \mathbf{Z}$.
   c- In this part, suppose that $z' = 1 + e^{i\theta}$ with $\theta \in \left]-\pi, \pi\right]$.
   Show that $\overrightarrow{OM} = 2\overrightarrow{AM'}$.

III- (4 points)

A survey conducted on a group of patients showed that these patients either have a heart disease only or a lung disease only or both diseases. It was noted that:

- 60 % of the patients are men.
- Among the men: 20 % have a heart disease only and 50% have a lung disease only.
- Among the women: 25% have a heart disease only and 40% have both diseases.

One patient is selected at random.

Consider the following events:

- M: "The selected patient is a men";
- H: "The selected patient has a heart disease only"
- L: "The selected patient has a lung disease only";
- B: "The selected patient has both diseases".

Part A

1) Calculate the probabilities $P(M \cap H)$, $P(M \cap L)$ and $P(M \cap B)$.
2) Calculate P(H), P(L) and verify that $P(B) = 0.34$.
3) Show that $P(H \cup L) = \dfrac{33}{50}$.
4) Knowing that the selected patient has only one disease, calculate the probability that this patient has a heart disease.

Part B

The group consists of 500 patients. The names of three patients were randomly and simultaneously selected to win an insurance policy each.

Knowing that the three selected patients have both diseases, calculate the probability that they are men.

IV- (8 points)

Part A

Consider the differential equation $(E): y' - y = -2x$.

Let $y = z + 2x + 2$.

1) Form the differential equation (E') satisfied by z.
2) Solve (E') and deduce the particular solution of (E) satisfying $y(0) = 0$.

Part B

Consider the function f defined over $\left]-\infty, +\infty\right[$ as $f(x) = 2x + 2 - 2e^x$.

Denote by (C) the representative curve of f in an orthonormal system $\left(O; \vec{i}, \vec{j}\right)$.

Let (Δ) be the straight line with equation $y = 2x + 2$.

1) a- Determine $\lim\limits_{x \to -\infty} f(x)$.

   b- Show that (C) is below (Δ) for all x.

   c- Show that (Δ) is an asymptote to (C).
2) Determine $\lim\limits_{x \to +\infty} f(x)$. Calculate $f(1)$ and $f(1.5)$.
3) Calculate $f'(x)$ and set up the table of variations of f.
4) Draw (Δ) and (C).
5) a- Show that f has, over $\left]0, +\infty\right[$, an inverse function g whose domain of definition is to be determined.

   b- Denote by (G) the representative curve of g and by (T) the tangent to (C) at the point with abscissa $\ln\left(\dfrac{3}{2}\right)$. Show that (T) is tangent to (G) at a point L whose abscissa is $2\ln\left(\dfrac{3}{2}\right) - 1$.