إرشادات عامة: - يسمح باستعمال آلة حاسبة غير قابلة للبرمجة أو اختزان المعلومات أو رسم البيانات.

- يستطيع المرشح الإجابة بالترتيب الذي يناسبه (دون الالتزام بترتيب المسائل الوارد في المسابقة).

I- (6 points)

In a country, the number of people y_i who were monthly infected by the Corona virus COVID-19 from March 2020 till August 2020 and the rank of the corresponding month x_i are represented in the following table:

Year 2020	March	April	May	June	July	August
Rank of the month: x_i	1	2	3	4	5	6
Number of infected people: y_i	200	250	504	555	942	1047

1) Determine the center of gravity $G(\overline{x} ; \overline{y})$.

2) Find the coefficient of correlation r and interpret the result thus obtained.

3) Determine an equation of the regression line $(D_{y/x})$ of y in terms of x.

4) Suppose that the preceding model remains valid till the end of the year 2020.

Estimate the number of people in this country who will be infected by COVID-19 during November 2020.

5) Calculate the percentage increase in the number of infected people in this country between May 2020 and June 2020.

II- (6 points)

In 2010, the owner of a shop had 1000 clients.

Each year, the number of clients of this shop decreases by 25% with respect to the preceding year and increases by 400 new clients.

Denote by U_n the number of clients in $(2010 + n)$, where $n \in \mathbb{N}$.

Thus, $U_0 = 1000$.

1) Verify that $U_1 = 1150$.

2) Justify that $U_{n+1} = 0.75U_n + 400$ for every n.

3) Let (V_n) be the sequence defined as $V_n = U_n - 1600$ for every n.

     a- Show that (V_n) is a geometric sequence with common ratio 0.75. Calculate its first term V_0.

     b- Verify that $U_n = 1600 - 600(0.75)^n$ for every n.

4) Find the number of clients of the shop in the year 2019.

5) The owner of the shop has a target to reach more than 1700 clients per year. Will his target be achieved? Justify.

III- (8 points)

Consider the function f defined over $]-\infty , +\infty[$ as $f(x) = (2x + 2)e^{-x + 1} + 1$.

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

1) Determine $\lim\limits_{x \to -\infty} f(x)$ and calculate $f(-1.25)$.

2) a- Show that the line (d) with equation $y = 1$ is an asymptote to (C).

     b- Determine the coordinates of the point A, the intersection of (C) and (d).

3) Verify that $f'(x) = -2xe^{-x + 1}$, then set up the table of variations of f.

4) a- Show that the equation $f(x) = 0$ has a unique root α.

     b- Verify that $-1.1 < \alpha < -1$.

5) Draw (d) and (C).

6) Let g be the function defined over $]-\infty , +\infty[$ as $g(x) = e^{f(x)}$.

     a- Verify that $g'(x)$ has the same sign as $f'(x)$ for every real number x.

     b- Set up the table of variations of g.