الامتحان الوطني الموحد للبكالوريا
المسالك الدولية – خيار أنجليزية
الدورة العادية 2018
-عناصر الإجابة-

NR 22E

المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي

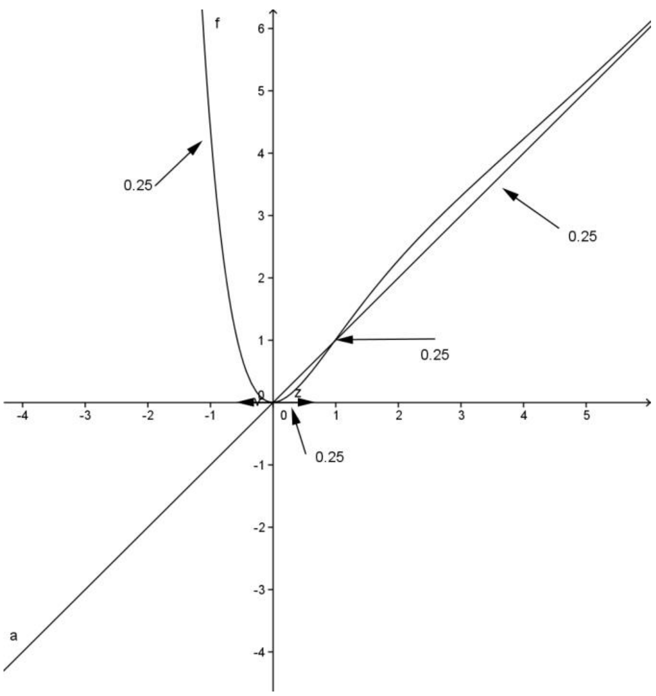
المركز الوطني للتقويم والامتحانات والتوجيه

3	مدة الإنجاز	الرياضيات	المادة
7	المعامل	مسلك علوم الحياة والأرض ومسلك العلوم الفيزيائية – خيار أنجليزية	الشعبة أو المسلك

On prendra en compte les différentes étapes de la solution et on acceptera toute méthode correcte .

Exercice1		
1		0.5 pour le produit vectoriel et 0.5 pour l'équation du plan
2		0.5
3	a	0.25
	b	0.5
4		0.25 pour la distance et 0.25 pour le rayon du cercle et 0.25 pour le centre du cercle
Exercice2		
1		0.25 pour le discriminant et 0.25 pour chacune des solutions
2	a	0.25
	b	0.5
3	a	0.25pour la vérification et 0.5 pour la déduction
	b	0.25 pour l'argument et 0.5 pour la déduction (on acceptera toute preuve correcte pour le triangle équilatéral)
Exercice3		
1		0.5 pour $p(A)=\frac{1}{6}$ et 0.5 pour $p(B)=\frac{1}{4}$ et 0.5 pour $p(C)=\frac{1}{42}$
2	a	0.5
	b	0.5 pour $p(X=1)=\frac{25}{72}$ et 0.5 pour $p(X=2)=\frac{5}{72}$

Problème			
I	1	0.25	
	2	0.25 pour le signe sur chacun des deux intervalles	
II	1	a	0.25 pour l'égalité et 0.25 pour la limite
		b	0.5 pour la limite et 0.25 pour la déduction
		c	0.25 pour l'égalité et 0.25 pour la limite
		d	0.25pour la limite et 0.25 pour l'interprétation
	2	a	0.25
		b	0.25 pour la courbe au dessus et 0.25 pour la courbe en dessous
	3	a	0.75
		b	0.25 pour chaque déduction
		c	0.25
	4	a	0.25
		b	0.25 pour la dérivée seconde s'annule et change de signe en 1 0.25 pour la dérivée seconde s'annule et change de signe en 4
	5	1 point à distribuer selon ce qui est précisé sur la figure ci dessous	



	6	a	0.25 pour la primitive et 0.25 pour la déduction
		b	0. 5 pour la technique de l'intégration par parties et 0.25 pour le calcul de l'intégrale
		c	0.5 pour la formule de l'aire et 0.25 pour la valeur de l'aire en cm^2
III	1	0.75	
	2	0.5	
	3	0.5 pour la convergence et 0.25 pour le calcul de la limite	

★★

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-الموضوع-

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وزارة التربية الوطنية
والتكوين المهني
والتعليم العالي والبحث العلمي

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ⴷ ⵓⵙⵍⵎⴷ ⴰⵏⴰⴼⵍⵍⴰ ⴷ ⵓⵔⵣⵣⵓ ⴰⵎⴰⵙⵙⴰⵏ

المركز الوطني للتقويم والامتحانات والتوجيه

3	مدة الإنجاز	الرياضيات	المادة
7	المعامل	مسلك علوم الحياة والأرض ومسلك العلوم الفيزيائية – خيار أنجليزية	الشعبة أو المسلك

GENERAL INSTRUCTIONS

- ✓ The use of non- programmable calculator is allowed ;
- ✓ The exercises can be treated in the preferred order by the candidate ;
- ✓ The use of red color when writing solutions is to be avoided.

COMPONENTS OF THE EXAM

- ✓ The exam consists of three exercises and a problem , independent of each other according to the fields as follows :

Exercise 1	Geometry in space	3 points
Exercise 2	Complex numbers	3 points
Exercise 3	Calculating probabilities	3 points
Problem	Study of numerical function, calculating integrals and numerical sequences	11 points

Exercise 1 : (3 points)

In the space referred to an orthonormal direct coordinate system $\left(O,\vec{i},\vec{j},\vec{k}\right)$,

we consider the points $A(0,\ -2,-2)$, $B(1,\ -2,-4)$ and $C(-3,-1,\ 2)$

1 — 1) Show that $\overrightarrow{AB}\wedge\overrightarrow{AC}=2\vec{i}+2\vec{j}+\vec{k}$ and deduce that $2x+2y+z+6=0$ is a cartesian equation of the plane (ABC)

2) Let (S) the sphere wich an equation is $x^2+y^2+z^2-2x-2z-23=0$

0.5 — Verify that the sphere (S) has the center $\Omega(1\,,0\,,\,1)$ and the radius $R=5$

0.25 — 3) a) Verify that $\begin{cases} x=1+2t \\ y=2t \\ z=1+t \end{cases}$; $(t\in\mathbb{R})$ is a parametric equations of the line (Δ) passing through the point Ω and perpendicular to the plane (ABC)

0.5 — b) Determine the coordinates of H the point of intersection of the line (Δ) and the plane (ABC)

0.75 — 4) Verify that $d\left(\Omega,(ABC)\right)=3$, and then show that the plane (ABC) intersects the sphere (S) along a circle of radius 4 wich the center will be determined.

Exercise 2 : (3 points)

0.75 — 1) Solve in the set of complex numbers $\mathbb{C}$ the equation $2z^2+2z+5=0$

2) In the complex plane referred to an orthonormal direct coordinate system $(O,\vec{u},\vec{v})$, we consider the rotation R with center O and angle $\dfrac{2\pi}{3}$

0.25 — a) Write in trigonometric form the complex number $d=\dfrac{-1}{2}+\dfrac{\sqrt{3}}{2}i$

0.5 — b) Let the point A of affix $a=\dfrac{-1}{2}+\dfrac{3}{2}i$ and the point B image of A by the rotation R

Let b the affix of the point B , show that $b=d.a$

3) Let t the translation with vector $\overrightarrow{OA}$ and the point C the image of B by t and c the affix of C

0.75 — a) Verify that $c=b+a$ and deduce that $c=a\left(\dfrac{1}{2}+\dfrac{\sqrt{3}}{2}i\right)$ (*you can use the question* 2) b))

0.75 — b) Determine $\arg\left(\dfrac{c}{a}\right)$ and deduce that the triangle OAC is equilateral.

Exercise 3 : (3 points)

An urn contains 9 balls, indistinguishable by touch : five red balls carrying the numbers

1 ; 1 ; 2 ; 2 ; 2 and four white balls carrying the numbers 1 ; 2 ; 2 ; 2

We consider the following experiment: we draw randomly and simultaneously three balls from the urn. We consider the events:

A : "The three balls drawn are of the same color"

B : " The three balls drawn carry the same number "

C : " The three balls drawn are of the same color and carry the same number "

1.5 — 1) Show that $p(A)=\frac{1}{6}$, $p(B)=\frac{1}{4}$ and $p(C)=\frac{1}{42}$

2) We repeat the previous experiment three times with returning the three balls drawn to the urn after each draw, and we consider X the random variable equal to the number of times of the realization of the event A.

0.5 — a) Determine the parameters of the binomial random variable X

1 — b) Show that $p(X=1)=\frac{25}{72}$ and calculate $p(X=2)$

Problem : (11 points)

I – We consider the numerical function g defined on IR by $g(x)=e^x-x^2+3x-1$

The table beside is the table of variations of the function g

x	$-\infty$ $\qquad$ $+\infty$
$g'(x)$	+
$g(x)$	$-\infty$ ↗ $+\infty$

0.25 — 1) Verify that $g(0)=0$

0.5 — 2) Determine the sign of $g(x)$ on each of the two intervals $]-\infty,0]$ and $[0,+\infty[$

II - We consider the numerical function f defined on IR by $f(x)=(x^2-x)\,e^{-x}+x$

and let (C) the curve of f in an orthonormal coordinate system $(O,\vec{i},\vec{j})$ (unit: $1cm$)

0.5 — 1) a) Verify that $f(x)=\frac{x^2}{e^x}-\frac{x}{e^x}+x$ for every x on IR and then show that $\lim_{x\to+\infty} f(x)=+\infty$

0.75 — b) Calculate $\lim_{x\to+\infty}(f(x)-x)$ and then deduce that (C) admits an asymptote (D) at $+\infty$ wich equation is $y=x$

0.5 — c) Verify that $f(x)=\frac{x^2-x+xe^x}{e^x}$ for every x on IR , and then calculate $\lim_{x\to-\infty} f(x)$

0.5 — d) Show that $\lim_{x\to-\infty}\frac{f(x)}{x}=-\infty$ and then interpret geometrically the obtained result

0.25	2) a) Verify that $f(x)-x$ and x^2-x have the same sign for every x on IR
0.5	b) Deduce that (C) is above (D) on each of the intervals $]-\infty,0]$ and $[1,+\infty[$, And below (D) on the interval $[0,1]$
0.75	3) a) Show that $f'(x)=g(x)\,e^{-x}$ for every x on IR
0.5	b) Deduce that the function f is decreasing on $]-\infty,0]$ and increasing on $[0,+\infty[$
0.25	c) Set up the table of variations of the function f
0.25	4) a) Verify that for every x on IR, $f''(x)=(x^2-5x+4)e^{-x}$
0.5	b) Deduce that the curve (C) admits two inflection points of respective abscissae 1 and 4
1	5) Sketch the line (D) and the curve (C) in the same system coordinate $(O,\vec{i},\vec{j})$ (we take $f(4)\approx 4,2$)
0.5	6) a) Show that the function $H: x \mapsto (x^2+2x+2)e^{-x}$ is a primitive of the function $h: x \mapsto -x^2e^{-x}$ on IR, and then deduce that $\int_0^1 x^2e^{-x}dx=\frac{2e-5}{e}$
0.75	b) Using an integration by parts, show that $\int_0^1 xe^{-x}dx=\frac{e-2}{e}$
0.75	c) Calculate, in cm^2, the area enclosed between the curve (C), the line (D), and the lines of equations $x=0$ and $x=1$
	III- We consider the numerical sequence (u_n) defined by $u_0=\frac{1}{2}$ and $u_{n+1}=f(u_n)$ for every natural number n
0.75	1) Show that $0\le u_n\le 1$ for every natural number n (*you can use the result of the question* II-3)b))
0.5	2) Show that the sequence (u_n) is decreasing .
0.75	3) Deduce that (u_n) is convergent and determine its limit.