الامتحان الوطني الموحد للبكالوريا
المسالك الدولية
الدورة العادية 2021
- عناصر الإجابة -

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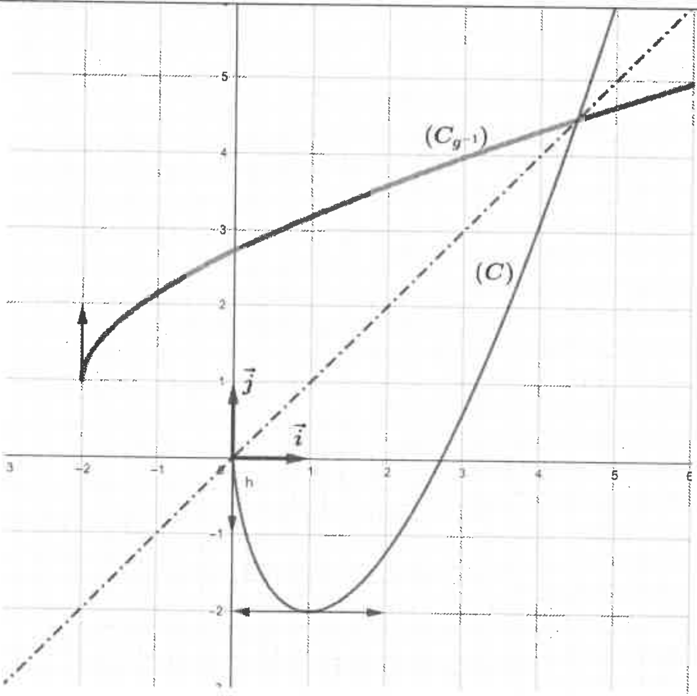
المملكة المغربية
وزارة التربية الوطنية والتكوين المهني والتعليم العالي والبحث العلمي
المركز الوطني للتقويم والامتحانات

3h	مدة الإنجاز	الرياضيات	المادة
7	المعامل	شعبة العلوم التجريبية مسلك علوم الحياة والأرض ومسلك العلوم الفيزيائية (خيار إنجليزية)	الشعبة أو المسلك

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

	Questions	Notes	Eléments de réponses
Exercice 1	1-a	0.5	
	1-b	0.5	
	1-c	0.5	
	2	0.5	
Exercice 2	1	0.25	
	2	0.5	
	3-a	0.5	
	3-b	0.5	
	4-a	0.75	0.5 pour l'encadrement et 0.25 pour la limite
	4-b	0.5	0.25 pour la continuité de la fonction et 0.25 pour la limite de la suite
	5-a	0.5	
	5-b	0.5	
Exercice 3	1	0.75	0.25 pour le discriminant et 0.25 pour chaque solution
	2-a	0.25	
	2-b	0.5	
	3	0.5	0.25 pour l'existence de l'homothétie et 0.25 pour son rapport
	4-a	0.5	
	4-b	0.25	
	4-c	0.5	
	5-a	0.75	0.25 pour la vérification et 0.5 pour l'argument
	5-b	0.5	
	5-c	0.5	
Problème	1	0.5	
	2-a	0.5	

Problème	2-b	0.5	0.25 pour la limite et 0.25 pour l'interprétation géométrique
	3-a	0.75	0.5 pour la limite et 0.25 pour l'interprétation géométrique
	3-b	0.5	
	3-c	0.5	
	4-a	0.5	0.25 pour chaque équation
	4-b	1	Voir le graphe ci-dessous: 0.25 pour la tangente horizontale, 0.25 pour la demi-tangente verticale, 0.25 pour la branche parabolique et 0.25 pour l'intersection avec l'axe des abscisses .
	5-a	0.5	
	5-b	0.5	
	6-a	0.25	
	6-b	0.5	
	7-a	0.5	
	7-b	0.75	Voir le graphe ci-dessous : 0.25 pour la demi-tangente verticale, 0.25 pour l'intersection avec l'axe des ordonnées et 0.25 pour l'intersection avec la première bissectrice du repère .
	8-a	0.5	
	8-b	0.5	
	8-c	0.25	



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الدورة العادية 2021
- الموضوع -

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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	numerical functions	2 points
Exercise 2	numerical sequences	4 points
Exercise 3	Complex numbers	5 points
Problem	Study of numerical functions and calculating integrals	9 points

- ✓ $\bar{z}$ denotes the conjugate of the complex number z
- ✓ ln denotes the Napierian logarithm function

	Exercise 1 : (2 points)
0.5	**1) a) Solve in $\mathbb{R}$ the equation with variable x :** $e^{2x}-4e^{x}+3=0$
0.5	**b) Solve in $\mathbb{R}$ the inequation with variable x :** $e^{2x}-4e^{x}+3\leq 0$
0.5	**c) Calculate** $\lim\limits_{x\to 0}\dfrac{e^{2x}-4e^{x}+3}{e^{2x}-1}$
0.5	**2) Show that the equation** $e^{2x}+e^{x}+4x=0$ **admits a solution in the interval** $[-1,0]$
	Exercise 2 : (4 points)
	Let (u_n) **be the numerical sequence defined by** $u_0=\dfrac{1}{2}$ **and** $u_{n+1}=\dfrac{u_n}{3-2u_n}$ **for every natural number** n
0.25	**1) Calculate** u_1
0.5	**2) Show by induction that** $0<u_n\leq\dfrac{1}{2}$ **for every natural number** n
0.5	**3) a) Show that** $\dfrac{u_{n+1}}{u_n}\leq\dfrac{1}{2}$ **for every natural number** n
0.5	**b) Deduce the monotonicity of the sequence** (u_n)
0.75	**4) a) Show that for every natural number** n, $0<u_n\leq\left(\dfrac{1}{2}\right)^{n+1}$ **, then calculate** $\lim u_n$
0.5	**b) We put** $v_n=\ln(3-2u_n)$ **for every natural number** n **, calculate** $\lim v_n$
0.5	**5) a) Verify that for every natural number** n, $\dfrac{1}{u_{n+1}}-1=3\left(\dfrac{1}{u_n}-1\right)$
0.5	**b) Deduce** u_n **in term of** n **for every natural number** n**.**
	Exercise 3 : (5 points)
0.75	**1) Solve in the set of complex numbers $\mathbb{C}$ the equation** $z^2-\sqrt{3}z+1=0$
	2) Let be the complex numbers $a=e^{i\frac{\pi}{6}}$ and $b=\dfrac{3}{2}+i\dfrac{\sqrt{3}}{2}$
0.25	**a) Write** a **in the algebraic form**
0.5	**b) Verify that** $\overline{a}b=\sqrt{3}$
	In the complex plane referred to a direct orthonormal coordinate system $(O,\vec{u},\vec{v})$ **, we consider the points** A,B **and** C **of respective affixes** a,b **and** $\overline{a}$ **.**
0.5	**3) Show that the point** B **is the image of the point** A **by the homothety** h **with center** O **and whose ratio will be determined.**

	4) Let z be the affix of a point M in the plane and z' the affix of the point M', image of M by the rotation R with center A and angle $\frac{\pi}{2}$
0.5	a) Write z' in term of z and a.
0.25	b) Let d be the affix of a point D, image of C by the rotation R, show that $d = a+1$
0.5	c) Let I be the point of affix the number 1, show that $ADIO$ is a rhombus.
0.75	5) a) Verify that $d - b = \frac{\sqrt{3}-1}{2}(1-i)$ and deduce an argument of the number $d - b$
0.5	b) Write the number $1 - b$ in trigonometrical form.
0.5	c) Deduce a measure of the angle $\left(\widehat{\overrightarrow{BI};\overrightarrow{BD}}\right)$
	Problem : (9 points)
	Consider the numerical function f defined on $[0,+\infty[$ by: $f(0)=0$ and $f(x)=2x\ln x-2x$ if $x>0$ and let (C) be its representative curve in an orthonormal coordinate system $(O,\vec{i},\vec{j})$ (unit: $1cm$)
0.5	1) Show that f is continuous at the point 0 on the right.
0.5	2) a) Calculate $\lim\limits_{x\to+\infty} f(x)$
0.5	b) Calculate $\lim\limits_{x\to+\infty} \frac{f(x)}{x}$ then interpret geometrically the result.
0.75	3) a) Calculate $\lim\limits_{x\to 0^+} \frac{f(x)}{x}$ then interpret geometrically the result.
0.5	b) Calculate $f'(x)$ for every x on $]0,+\infty[$
0.5	c) Set up the table of variations of the function f on $[0,+\infty[$
0.5	4) a) Solve in the interval $]0,+\infty[$ the equations $f(x)=0$ and $f(x)=x$
1	b) Sketch the curve (C) in the coordinate system $(O,\vec{i},\vec{j})$ (we take $e^{\frac{3}{2}} \simeq 4.5$)
0.5	5) a) Using an integration by parts, show that $\int_1^e x\ln x\,dx = \frac{1+e^2}{4}$
0.5	b) Deduce $\int_1^e f(x)dx$
0.25	6) a) Determine the minimum of f on $]0,+\infty[$
0.5	b) Deduce that for every x on $]0,+\infty[$, $\ln x \geq \frac{x-1}{x}$

	7) Let g be the restriction of the function f on the interval $[1,+\infty[$
0.5	**a) Show that g admits an inverse function g^{-1} defined on an interval J which will be determined.**
0.75	**b) Sketch in the same coordinate system $(O,\vec{i},\vec{j})$ the curve of the function g^{-1}**
	8) Consider the function h defined on $\mathbb{R}$ by $\begin{cases} h(x)=x^3+3x & ; x\leq 0 \\ h(x)=2x\ln x-2x & ; x>0 \end{cases}$
0.5	**a) Study the continuity of h at the point 0**
0.5	**b) Study the differentiability of h at the point 0 on the left, then interpret geometrically the result.**
0.25	**c) The function h is-it differentiable at the point 0 ? justify.**