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# الامتحان الوطني الموحد للبكالوريا

الممالك الدولية

الدورة الاستدراكية 2020  
- عناصر الإجابة -

ROYAUME DU MAROC  
الجمهورية المغربية  
وزارة التربية الوطنية  
والتكوين المهني  
والتعليم العالي والبحث العلمي  
المركز الوطني للتقويم والامتحانات



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RR 24E

4	مدة الإنجاز	الرياضيات	المادة
9	المعامل	شعبة العلوم الرياضية (أ) و (ب) (خيار إنجليزية)	الشعبة أو المسلك

**N.B :** If the candidate treats the two optional exercises ( totally or partially) , we assing the best score of the two obtained scores ( and not the sum of these two scores).

EXERCISE1	Indications of solutions		M
1-	a)	Use BEZOUT's theorem or a directly proof	0.5
	b)	Use FERMAT's theorem .....0.5 and replace in $9^{p-1+q} \equiv 1 [p]$ .....0.5	1
2-	a)	We have $p-1 < p < q$ and $q$ a prime number	0.5
	b)	$(u,v) \in \mathbb{Z}^2 : uq = 1 + v(p-1)$ and $9^{uq} \equiv 1 [p]$ and $9^{v(p-1)} \equiv 1 [p]$ then $9 \equiv 1 [p]$ then $p$ divides $8 = 2^3$ .....	0.5
3-	a)	$q \nmid 9 = 1$ and we use FERMAT's theorem	0.5
	b)	If we replace $p$ by 2 then $9^{q+1} \equiv 1 [q]$ since $9^{q-1} \equiv 1 [q]$ then $9^2 \equiv 1 [q]$ then $q$ divides $80 = 2^4 \cdot 5$ and $q > 2$ then $q = 5$	0.5

EXERCISE2	Indications of solutions		M
<b>First part :</b>			
1-	a)	Sub-space test	0.25
	b)	Spaning family .....0.25 We show that its elements are linearly independent .....0.25	0.5

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2-	a)	The verification	0.25
	b)	$(E, +)$ is a commutative group  $E$ is stable for the multiplication in $M_3(\square)$  The multiplicative Law is associative and distributive on the addition by stability  The multiplicative law is commutative in $E$ by 2-a)	0.5
<b>Second part :</b>			
1-		One-step or two-step test for sub-group	0.25
2-	a)	$\varphi$ is a morphism from $(\square^*, \times)$ to $(E, \times)$	0.25
	b)	$\varphi(\square^*) = F^*$ and $(\square^*, \times)$ is a commutative group	0.5
	c)	$(F, +, \times)$ is a commutative field with unit  $\varphi(1) = M(1, 0, 0) = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 1 & 1 \end{pmatrix}$	0.5
3-	a)	The verification	0.25
	b)	No element of $F$ is regular for the multiplication in $M_3(\square)$	0.25

EXERCISE3		Indications of solutions	M	
I-	1-	The two solutions of $(E)$ are : $z_1 = -1 + im$ and $z_2 = \overline{z_1}$	0.5	
	2-	a)	$2i$ is the pure imaginary solution	0.25
		b)	The others solutions of $(F)$ are those of $(E)$ : $z_1$ and $z_2$	0.5
II-	1-	The values of $p, q,$ and $r$ in term of $m$	0.5x3	
	2-	a)	The verification	0.25
		b)	$ p  =  q - r $ and $\arg \frac{q-r}{p} \equiv -\frac{\pi}{2} [2\pi]$	0.25x2

EXERCISE4	Indications of solutions	M	
<b>First part :</b>			
1-	a)	$f$ is differentiable on $I$ .....0.25 The calculation of the differentiable function.....0.5	0.75
	b)	The differentiable function is strictly decreasing on $I$	0.5
	c)	The existence and unicity of $\alpha$ .....0.5 $f(\alpha) = \frac{\alpha^2}{2-\alpha}$ .....0.25	0.75
2-	a)	Variations of $f$ .....0.5 V. T of $f$ .....0.25	0.75
	b)	The second differentiable function is negative (or the first differentiable function is strictly decreasing)	0.5
	c)	The curve is always under its tangent	0.5
	d)	Particular cases of the tangents at the points of abscissas 0 et 1	0.5
3-	Graphic representation	0.5	
4-	The calculation of the area: $I = \left( \int_0^1 f(x) dx \right) \cdot 4cm^2 = \left( 2\ln 2 - \frac{5}{4} \right) \cdot 4cm^2$	0.75	
<b>Second part :</b>			
1-	a)	Verification that $f_n$ is positive.....0.25 Verification that $f_n(0) = f_n(1) = 0$ .....0.25	0.5
	b)	Application of the ROLLE's theorem to the function $f_n$ on $[0;1]$	0.5
2-	a)	$f_n$ is differentiable .....0.25 Calculation of $f_n'$ ..... 0.5	0.75

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	b)	$g_n$ is strictly decreasing on $I$	0.5
	c)	$g_n$ is strictly decreasing (injective) therefore the unicity of $\alpha_n$	0.5
3-	a)	Expression of $f_n(\alpha_n)$ .....0.5 Calculation of the limit $0 < a_n < 1$ so $0 < \frac{(a_n)^{n+1}}{2 - a_n} < 1$ ..... 0.5	1
	b)	Expression of $g_n(\alpha_{n+1})$ .....0.5 Monocity of the sequence $(\alpha_n)$ .....0.5	1
	c)	The sequence is Increasing and bounded above .....	0.25
	d)	Calculation of the limit	0.5
<b>Third part :</b>			
1-		The sequence $(I_n)$ is decreasing.....0.5 The sequence is bounded below then it is convergent .....0.25	0.75
2-		Integration by parts	0.5
3-		The apply of squeeze theorem to $I_n$ ..... 0.5 Calculation of the limit.....0.25	0.75

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