مجلس الخدمة المدنية

ادارة الموظفيـــــن

اللجنـــة الفاحصـة

مباراة ٢٠٠٤/٤/٢٧ للتعيين بوظيفة استاذ تعليم ثانوي .

مسابقة في الثقافة العامة باللغة العربية .   الوقت: ساعتان

الاختصاص: رياضيات باللغتين الفرنسية والانكليزية

جاء في مقدمة مناهج التعليم العام واهدافها لمادة الرياضيات :

" تشكل الرياضيات نشاطا فكريا ذا ابعاد انسانية كبرى ، فهي حقل خصب لنمو الفكر النقدي ، وللموضوعية والدقة والإحكام ، ولتأصّل العادة على الأمانة العلمية ...

وأن التقدم الحثيث للعلوم والتكنولوجيا قد ترك أثرا عميقا في المجتمـع الحـديث ... والعالم باسره مجمع على أنّ هذا التطور ما كان ليتم لولا الأداة الرياضية التي اتاح استعمالها استبدال الوصف النوعي للواقع بالبيان الكمّي والنماذج العملانية " .

اشرح هذا القول وناقشه مبيّنا :

١- دور الرياضيات في بناء شخصية المتعلم .

٢- دور الرياضيات في تطور العلوم والتكنولوجيا .

٣- اثر تطور العلوم وتكاملها في بناء المجتمعات .

بيروت، في ٢٠٠٤/٧/٢٧

اللجنة الفاحصة

مجلس الخدمة المدنية
ادارة الموظفين
اللجنة الفاحصة

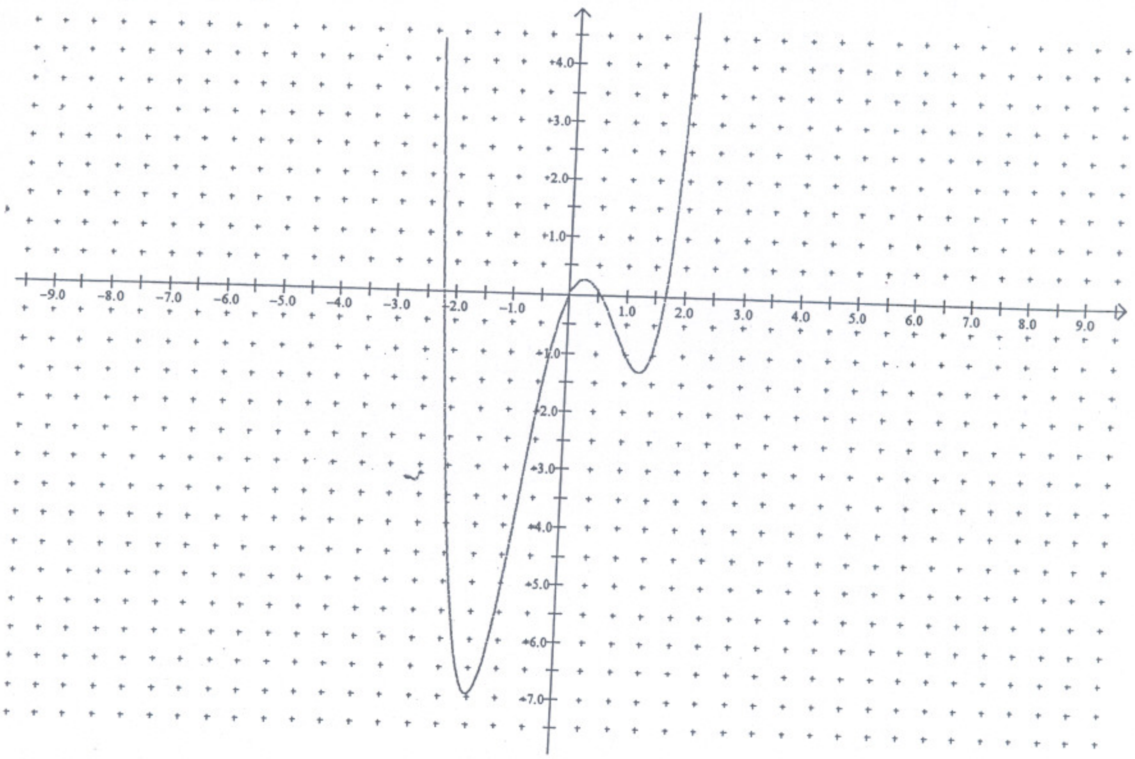
مباراة 2004/7/27 المحصورة للتعيين في وظيفة
استاذ تعليم ثانوي في ملاك وزارة التربية و التعليم العالي

الاختصاص : الرياضيات
المسابقة : في الاختصاص المطلوب

المدة : اربع ساعات

ملاحظة : يسمح باستعمال الآلة الحاسبة غير القابلة للبرمجة.

I – Graph reading



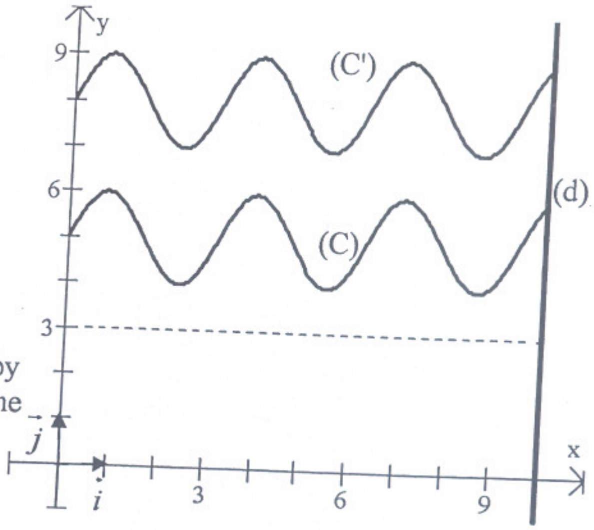
The above curve represents a numerical function f.

1. Is the function f continuous?
2. Give approximate values of the coordinates of the extrema of f.
3. Study the sign of the derivative f' of f.
4. Give approximate values of the roots of the equation $f(x) = 0$.

II – Calculation of area

Consider the adjacent figure :

- (d) is the line of equation $x = 10$.
- The curve (C') is obtained from the curve (C) by a translation of vector $\vec{v} = 3\vec{j}$.



Calculate the area of the domain (D) limited by the two curves (C) and (C'), the y-axis and the line (d).

III - Functions

Let f be the function defined over $\mathbb{R}$ by the relation

$$f(x_1 + x_2) = \frac{f(x_1) + f(x_2)}{1 + f(x_1)f(x_2)}$$

with $f(x_1)f(x_2) \neq -1$ for all $x_1 \in \mathbb{R}$ and all $x_2 \in \mathbb{R}$, where $\mathbb{R}$ is the set of real numbers.

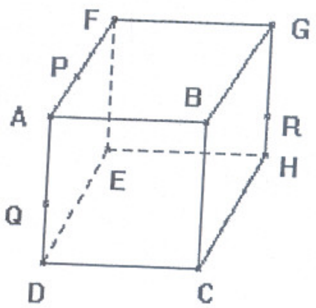
1. Show that the possible values of $f(0)$ are -1, 0 and +1.
2. Show that if $f(0) = -1$ or $f(0) = 1$, then the function f is constant.

In what follows, assume that $f(0) = 0$.

3. Show that the function f is odd.
4. Show that $f(x)$ is different from -1 and +1 for all $x \in \mathbb{R}$.
5. Show that $|f(x)| < 1$ for all $x \in \mathbb{R}$.

IV – Solid geometry

ABCDEFGH is a cube as indicated in the adjacent figure. *P* is a point of the side [*AF*], *Q* is a point of the side [*AD*] and *R* is a point of the side [*GH*].



Construct the intersection of the plane (*PQR*) with the faces of the cube.

V – Analytic geometry

Let (P_m) be the family of planes defined by :

$$(m+2)x - 2(m-1)y + (3-m)z + (m+3) = 0$$

1. Show that all the planes of this family pass through the same straight line (d).
2. Find a system of parametric equations for the straight line (d).
3. Is there a line passing through point $A(0, 0, 1)$ and parallel to all the planes of this family? Justify your answer.

VI – Complex numbers

Let A, B and C be three points of the complex plane with respective affixes the complex numbers a, b and c. Show that if $|a| = |b| = |c| = 1$ and $a + b + c = 0$, then the triangle ABC is equilateral.

VII – Counting

We have 10 chairs in a row. In how many different ways can 5 married couples (5 husbands and their 5 wives) sit on these chairs if :

1. No special order is required ?
2. The men sit together on one side and the women on the other ?
3. Each man sits next to his wife ?

VIII - Probability

10% of the population of a village have a lung disease.. 85% of the persons having this disease are smokers, while 20% of the persons not having the disease are smokers.

1. Calculate the probability that a randomly selected smoker has the disease ?
2. Calculate the probability that a randomly selected non-smoker doesn't have the disease ?

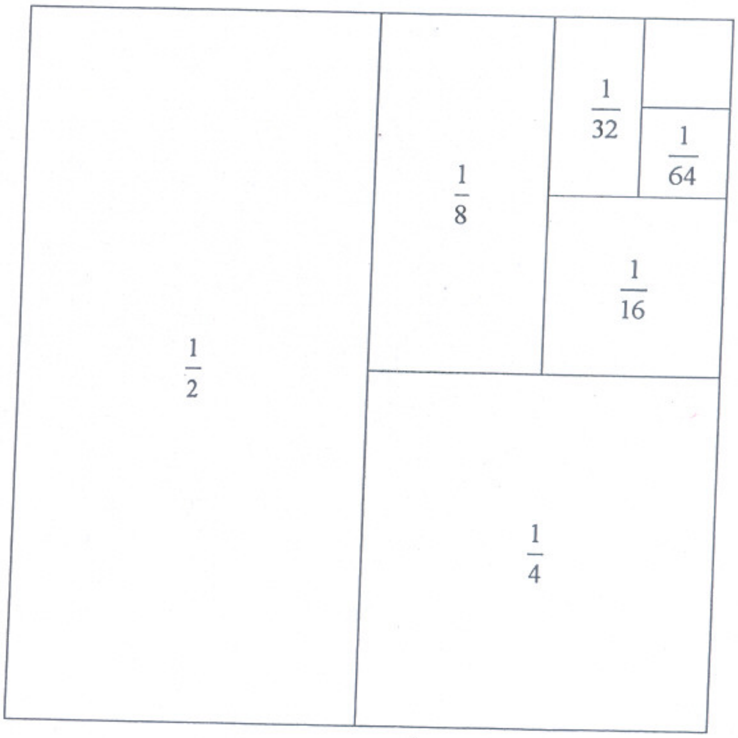
IX – Sequences

Consider the sequence :

$$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \dots$$

where the first term is $u_1 = \frac{1}{2}$.

1. Give the general term of this sequence.
2. Using the adjacent figure where the side of the largest square is 1, conjecture the sum $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\cdots$ of the terms of this sequence.
3. Find this sum by another method.



X – Statistics

The adjacent table gives the distribution of ages in percentage of the Lebanese population 90 years old and below, estimated in 1996.

1. Calculate the mean, median, and mode of this distribution.
2. Draw the histogram of this distribution and estimate the mode graphically.
3. Draw the curve of the increasing cumulative percentages and estimate the median graphically.

Age Classes	Percentages
[0 ; 10[	19.2
[10 ; 20[	20.5
[20 ; 30[	18.2
[30 ; 40[	14.7
[40 ; 50[	9.6
[50 ; 60[	7.7
[60 ; 70[	6.1
[70 ; 80[	3.2
[80 ; 90]	0.8

(Use graph paper).

XI – Differential Equations

1. Determine the real constants *a, b,* and *c* such that :

$$\int x^2e^{-x}dx = \left(ax^2 + bx + c\right)e^{-x} + k$$

where k is an arbitrary constant.

2. Consider the differenmtial equation

$$(E): \quad x^2y' - \left(x^2 - 4x\right)y + 1 = 0$$

Let $z = x^4e^{-x}y$. Find the differential equation (E_1) satisfied by z. Solve (E_1) and deduce the general solution of (E).

بيروت في 2004/8/9 اللجنة الفاحصة

مجلس الخدمة المدنية
ادارة الموظفين
اللجنة الفاحصة

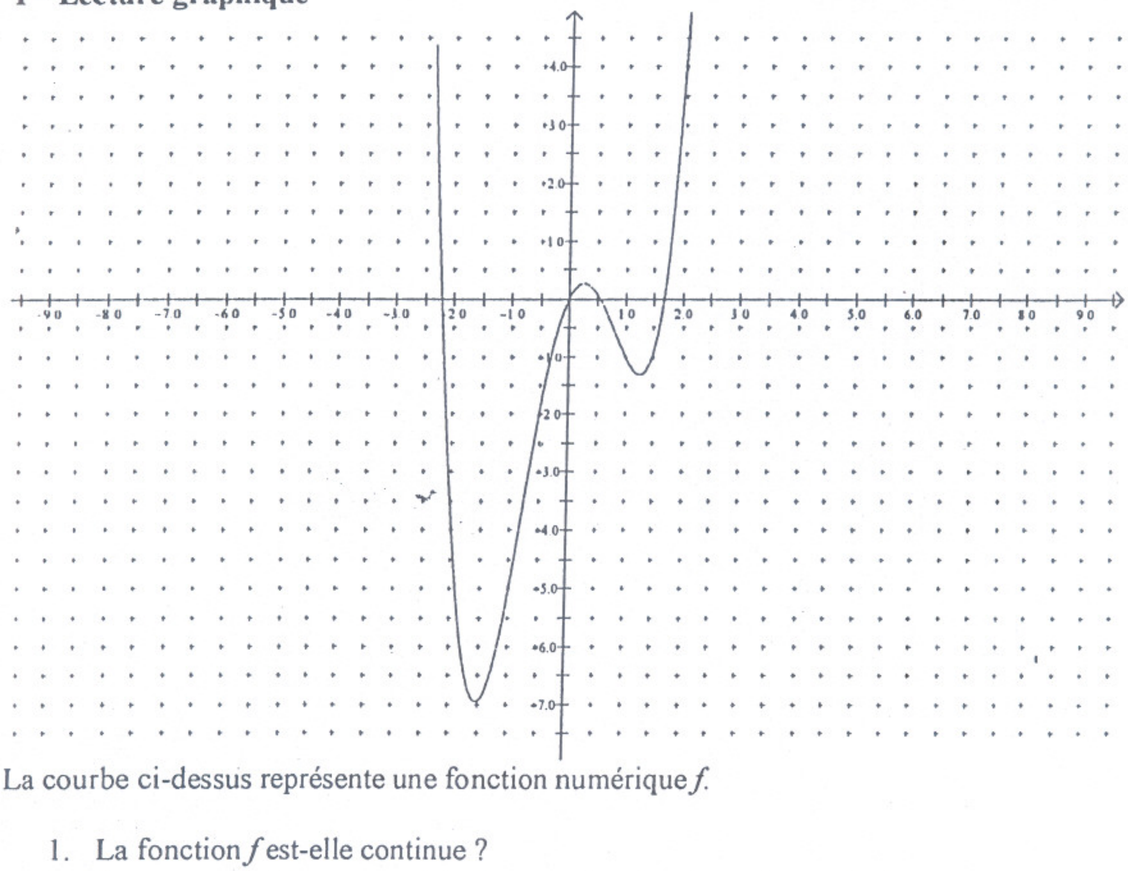
مباراة 2004/7/27 المحصورة للتعيين في وظيفة
استاذ تعليم ثانوي في ملاك وزارة التربية و التعليم العالي

الاختصاص : الرياضيات

المسابقة : في الاختصاص المطلوب — **المدة** : اربع ساعات

ملاحظة : يسمح باستعمال الآلة الحاسبة غير القابلة للبرمجة.

I – Lecture graphique



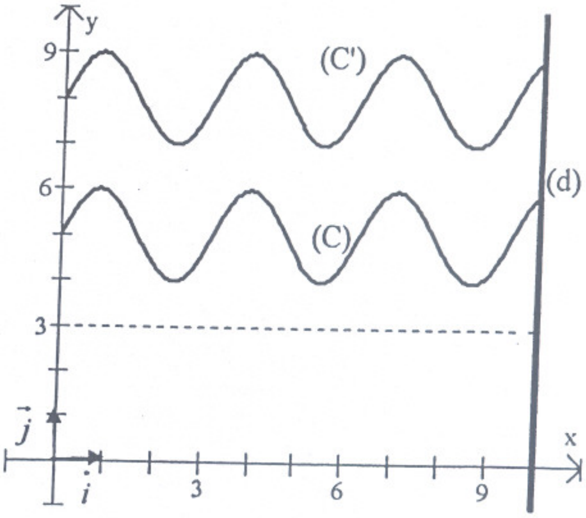
La courbe ci-dessus représente une fonction numérique f.

1. La fonction f est-elle continue ?
2. Donnez une valeur approchée des coordonnées des extrema de f.
3. Etudiez le signe de la dérivée f' de f.
4. Donnez des valeurs approchées des racines de l'équation $f(x) = 0$.

II – Calcul d'aire

Sur la figure ci-contre :

- (d) est la droite d'équation $x = 10$.
- La courbe (C') est obtenue à partir de la courbe (C) par une translation de vecteur $\vec{v} = 3\vec{j}$.



Calculez l'aire du domaine (D) délimité par les deux courbes (C) et (C'), l'axe des y et la droite (d).

III _ Fonctions

Soit f la fonction réelle définie sur $\mathbb{R}$ et vérifiant la relation

$$f(x_1 + x_2) = \frac{f(x_1) + f(x_2)}{1 + f(x_1)f(x_2)}$$

avec $f(x_1)f(x_2) \neq -1$ pour tout $x_1 \in \mathbb{R}$ et tout $x_2 \in \mathbb{R}$ où R est l'ensemble des nombres réels.

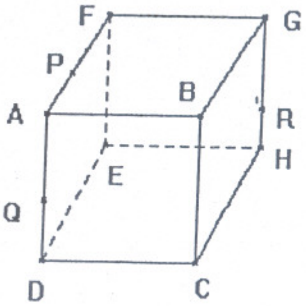
1. Montrez que les valeurs possibles de $f(0)$ sont -1, 0 et +1.
2. Montrez que si $f(0) = -1$ ou $f(0) = 1$, alors la fonction f est constante.

On suppose, dans la suite du problème, que $f(0) = 0$.

3. Montrez que la fonction f est impaire.
4. Montrez que $f(x)$ est différent de -1 et de +1 pour tout $x \in \mathbb{R}$.
5. Montrez que $|f(x)| < 1$ pour tout $x \in \mathbb{R}$.

IV – Géométrie dans l'espace.

ABCDEFGH est un cube comme sur la figure ci-contre. P est un point de l'arête $[AF]$, Q est un point de l'arête $[AD]$ et R est un point de l'arête $[GH]$.



Construisez l'intersection du plan (PQR) avec les faces du cube.

V – Géométrie analytique

On considère la famille des plans (P_m) définie par :

$$(m+2)x - 2(m-1)y + (3-m)z + (m+3) = 0$$

1. Démontrez que tous les plans de cette famille passent par une même droite (d).
2. Trouvez un système d'équations paramétriques pour la droite (d).
3. Existe-t-il une droite passant par le point $A(0, 0, 1)$ et parallèle à tous les plans de la famille ? Justifiez votre réponse.

VI – Nombres complexes.

On considère dans le plan complexe trois points A, B et C d'affixes respectifs les nombres complexes a, b et c. Démontrer que si $|a| = |b| = |c| = 1$ et si $a + b + c = 0$, alors le triangle ABC est équilatéral.

VII – Dénombrement

On dispose de 10 chaises alignées. De combien de façons peut-on placer sur ces chaises 5 couples mariés (5 hommes et leurs cinq femmes) si :

1. Aucun ordre n'est exigé ?
2. Les hommes sont placés ensemble d'un côté et les femmes de l'autre ?
3. Chaque homme se place à côté de sa femme ?

VIII - Probabilités

10% de la population d'un village souffrent d'une maladie de poumons. Parmi les personnes qui ont cette maladie 85% sont des fumeurs. Parmi celles qui n'ont pas cette maladie 20% sont des fumeurs.

1. Calculez la probabilité pour qu'un fumeur choisi au hasard dans cette population ait la maladie des poumons ?
2. Calculez la probabilité pour qu'un non-fumeur choisi au hasard dans cette population ne souffre pas de cette maladie ?

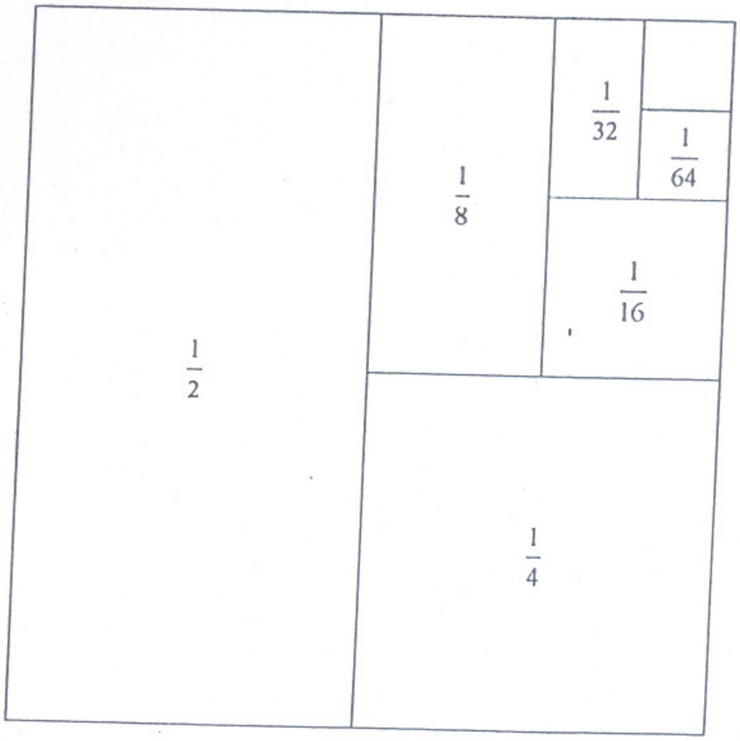
IX – Suites

On considère la suite :

$$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \cdots$$

où le premier terme est $u_1 = \frac{1}{2}$.

1. Donnez le terme général de cette suite ?
2. Utilisez la figure ci-contre, où le grand carré est de côté 1, pour conjecturer la somme $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \cdots$ de tous les termes de cette suite. Justifiez.
3. Trouvez la somme des termes de cette suite par une autre méthode.



X – Statistique

Le tableau ci-contre donne la distribution en pourcentage des âges de la population libanaise entre 0 et 90 ans estimée en 1996.

1. Calculez la moyenne, la médiane et le mode de cette distribution.
2. Tracez l'histogramme de la distribution et estimez graphiquement le mode.
3. Tracez la courbe des pourcentages cumulés croissants et estimez graphiquement la médiane.

(Utilisez le papier millimétré).

Classes d'âge	Pourcentages
[0 ; 10[	19,2
[10 ; 20[	20,5
[20 ; 30[	18,2
[30 ; 40[	14,7
[40 ; 50[	9,6
[50 ; 60[	7,7
[60 ; 70[	6,1
[70 ; 80[	3,2
[80 ; 90]	0,8

XI – Equations différentielles

1. Déterminez les constantes réelles a, b et c telles que :
$$\int x^2 e^{-x} dx = \left(ax^2 + bx + c\right)e^{-x} + k$$
où k est une constante arbitraire.

2. Soit l'équation différentielle
$$(E) : \quad x^2 y' - \left(x^2 - 4x\right)y + 1 = 0$$
On pose $z = x^4 e^{-x} y$. Trouvez l'équation différentielle (E_1) vérifiée par z.
Résoudre (E_1) et en déduire la solution générale de (E).

بيروت في 2004/8/9　　　　　　　　اللجنة الفاحصة

مجلس الخدمة المدنية
ادارة الموظفين
اللجنة الفاحصة

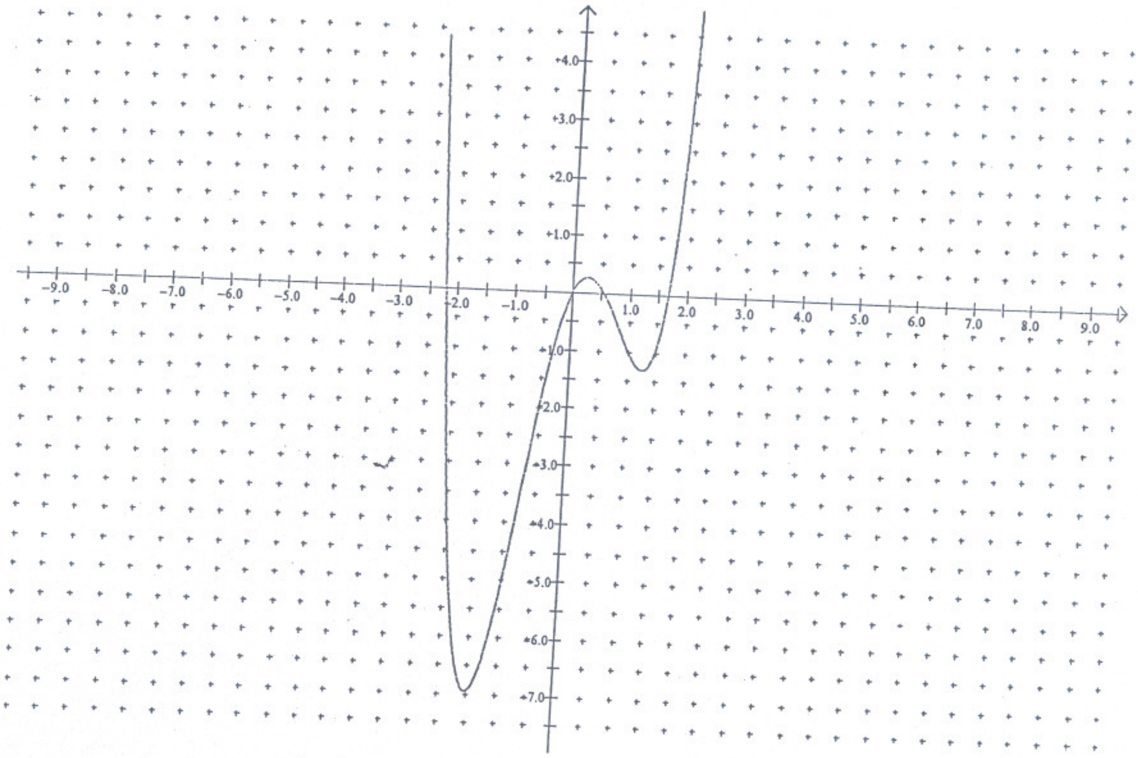
مباراة 2004/7/27 المحصورة للتعيين في وظيفة
استاذ تعليم ثانوي في ملاك وزارة التربية و التعليم العالي

الاختصاص : الرياضيات
المسابقة : في الاختصاص المطلوب

المدة : اربع ساعات

ملاحظة : يسمح باستعمال الآلة الحاسبة غير القابلة للبرمجة.

I – Graph reading



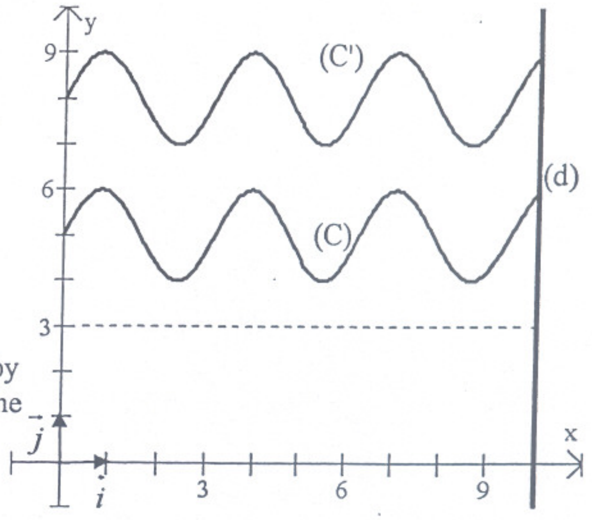
The above curve represents a numerical function f.

1. Is the function f continuous?
2. Give approximate values of the coordinates of the extrema of f.
3. Study the sign of the derivative f' of f.
4. Give approximate values of the roots of the equation $f(x) = 0$.

II – Calculation of area

Consider the adjacent figure :

- (d) is the line of equation $x = 10$.
- The curve (C') is obtained from the curve (C) by a translation of vector $\vec{v} = 3\vec{j}$.



Calculate the area of the domain (D) limited by the two curves (C) and (C'), the y-axis and the line (d).

III - Functions

Let f be the function defined over R by the relation

$$f(x_1 + x_2) = \frac{f(x_1) + f(x_2)}{1 + f(x_1)f(x_2)}$$

with $f(x_1)f(x_2) \neq -1$ for all $x_1 \in \mathbb{R}$ and all $x_2 \in \mathbb{R}$, where R is the set of real numbers.

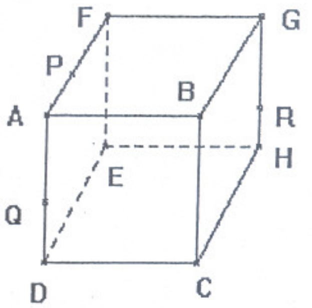
1. Show that the possible values of $f(0)$ are -1, 0 and +1.
2. Show that if $f(0) = -1$ or $f(0) = 1$, then the function f is constant.

In what follows, assume that $f(0) = 0$.

3. Show that the function f is odd.
4. Show that $f(x)$ is different from -1 and +1 for all $x \in \mathbb{R}$.
5. Show that $|f(x)| < 1$ for all $x \in \mathbb{R}$.

IV – Solid geometry

ABCDEFGH is a cube as indicated in the adjacent figure. P is a point of the side $[AF]$, Q is a point of the side $[AD]$ and R is a point of the side $[GH]$.



Construct the intersection of the plane (PQR) with the faces of the cube.

V – Analytic geometry

Let (P_m) be the family of planes defined by :

$$(m+2)x - 2(m-1)y + (3-m)z + (m+3) = 0$$

1. Show that all the planes of this family pass through the same straight line (d).
2. Find a system of parametric equations for the straight line (d).
3. Is there a line passing through point $A(0, 0, 1)$ and parallel to all the planes of this family? Justify your answer.

VI – Complex numbers

Let A, B and C be three points of the complex plane with respective affixes the complex numbers a, b and c. Show that if $|a| = |b| = |c| = 1$ and $a + b + c = 0$, then the triangle ABC is equilateral.

VII – Counting

We have 10 chairs in a row. In how many different ways can 5 married couples (5 husbands and their 5 wives) sit on these chairs if :

1. No special order is required ?
2. The men sit together on one side and the women on the other ?
3. Each man sits next to his wife ?

VIII - Probability

10% of the population of a village have a lung disease.. 85% of the persons having this disease are smokers, while 20% of the persons not having the disease are smokers.

1. Calculate the probability that a randomly selected smoker has the disease ?
2. Calculate the probability that a randomly selected non-smoker doesn't have the disease ?

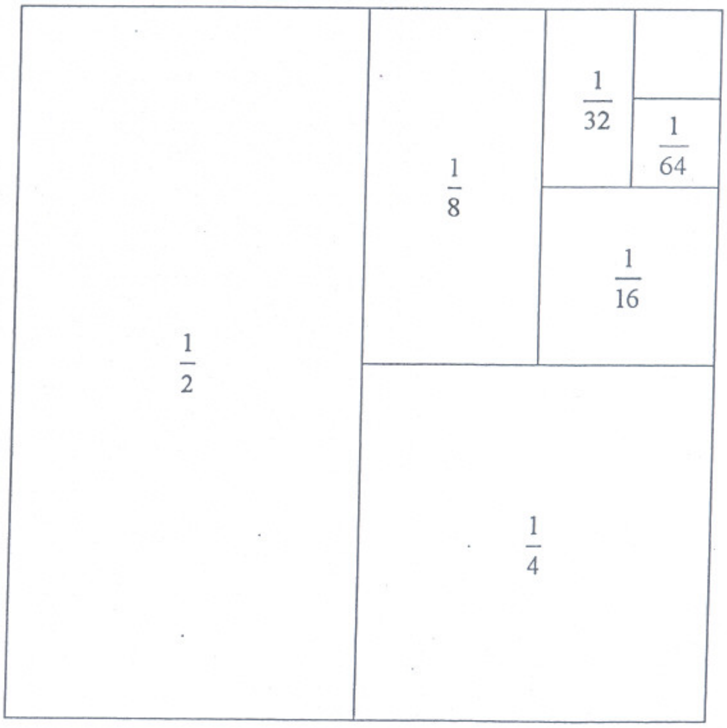
IX – Sequences

Consider the sequence :

$$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \frac{1}{32}, \dots$$

where the first term is $u_1 = \frac{1}{2}$.

1. Give the general term of this sequence.
2. Using the adjacent figure where the side of the largest square is 1, conjecture the sum $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32} + \cdots$ of the terms of this sequence.
3. Find this sum by another method.



X – Statistics

The adjacent table gives the distribution of ages in percentage of the Lebanese population 90 years old and below, estimated in 1996.

1. Calculate the mean, median, and mode of this distribution.
2. Draw the histogram of this distribution and estimate the mode graphically.
3. Draw the curve of the increasing cumulative percentages and estimate the median graphically.

Age Classes	Percentages
[0 ; 10[	19.2
[10 ; 20[	20.5
[20 ; 30[	18.2
[30 ; 40[	14.7
[40 ; 50[	9.6
[50 ; 60[	7.7
[60 ; 70[	6.1
[70 ; 80[	3.2
[80 ; 90]	0.8

(Use graph paper).

XI – Differential Equations

1. Determine the real constants a, b, and c such that :

$$\int x^2 e^{-x} dx = \left(ax^2 + bx + c\right) e^{-x} + k$$

where k is an arbitrary constant.

2. Consider the differenmtial equation

$$(E): \quad x^2 y' - \left(x^2 - 4x\right) y + 1 = 0$$

Let $z = x^4 e^{-x} y$. Find the differential equation (E_1) satisfied by z. Solve (E_1) and deduce the general solution of (E).

بيروت في 2004/8/9 اللجنة الفاحصة