ليسه دي زار

الشهادة المتوسطة التجربة الثالثة لعام 2011 – 2012

مسابقة في الرياضيات الإنكليزي	المدّة : ساعتين	الإسم :	الرقم :

إرشادات عامة:

- يسمح بإستعمال آلة حاسبة غير قابلة للبرمجة
- يمكن الإجابة على المسائل بالترتيب الذي تريد
- يرجى الإجابة بخط واضح ومرتب
- العلامة القصوى من 30
- عدد المسائل: 4

1st exercise: (7 ½ pts)

In this exercise, the five parts are independent. (1 ½ pts for each part)

1) Let E = (sinx – cosx – 1). (sinx – cosx + 1). Calculate E.
2) The table below shows the ages of 40 persons.

Age	15	16	17	18	19
Frequency	9	11	x	9	y

   Calculate x and y knowing that the mean age is 16.8.

3) Consider the two polynomials:

   $P(x) = 9x^3 + 9x^2 + (c-1)x + 5$

   $Q(x) = (a^2 - b^2)x^3 + (a+b)x^2 + 2d - 1$

   Determine a, b, c and d so that P(x) and Q(x) are identical.

4) Consider in an orthonormal system (x'ox), (y'oy) the points E(3; 2), F(5; - 3); and G(1; 4). Determine the coordinates of the point H such that EFGH is a parallelogram.
   (Note: you can draw a sketch if you want)
5) a) Given the real number $T = \dfrac{\sqrt{45} + \sqrt{20} - 3\sqrt{5} + \sqrt{36}}{\sqrt{125} - \sqrt{80} + \sqrt{9}}$.

   Show that T is an integer.

   b) Deduce that T is a solution of the inequality $5(x+1) - 3\dfrac{x}{2} - 1 > \dfrac{x}{2} - 5$

2nd exercise: (5 ½ pts)

Upon studying the type of cellular phones used by each of the 25 students of grade 9, we obtained the following results organized in the table below:

Type of cellular phone	Nokia	iphone	Blackberry	Samsung
Frequency	x + 1	4x + 1	x + 3	3x + 2

(x is a natural number)

1) Determine the character and its nature. (½ pt)
2) Show that x = 2, then determine the most used cellular phone. (1pt)
3) a) Set up the table of frequencies and the central angles in degrees. (1 ½ pts)
   b) Draw the semi-circular diagram for this statistical distribution. (1pt)
4) Can you determine the increasing cumulative frequencies? Justify. (¾ pt)
5) Calculate the percentage of the students who have Blackberry phones. (¾ pt)

3rd exercise: (11pts)

In the plane of an orthonormal system (x'ox), (y'oy), where the unit of length is the centimeter, consider the straight-line (d) of equation y – 2x = -4 and the point $H\left(\frac{a}{5};\frac{-a}{10}\right)$ (a is an integer).

1) Draw the straight-line (d). (½ pt)
2) a) Calculate a so that H belongs to (d). Plot H. (¾ pt)

   b) Let $H\left(\frac{8}{5};\frac{-8}{10}\right)$, show that H is the orthogonal projection of O and (d). (1pt)
3) a) (d) cuts (x'ox) at A and (y'y) at B. Calculate the coordinates of A and B. (½ pt)

   b) Determine $Cos A\hat{O}H$ and $Sin O\hat{B}H$ in terms of OH only. (1 ½ pts)

   c) Show that $A\hat{O}H$ and $O\hat{B}H$ are equal. (¾ pt)

   d) Let $A\hat{O}H = O\hat{B}H = \alpha$ and use **part b** to show that $OH = \frac{4\sqrt{5}}{5} cm$. (1pt)
4) a) Calculate to the nearest 10^{-2} degree the angle $O\hat{A}B$ using the equation of (d). (¾ pt)

   b) (d_2) is a decreasing straight-line passing through A and making an acute angle of 60^o with (x'ox). Determine an equation of (d_2). (¾ pt)
5) Given the point C(0; 2). Designate by I the midpoint of [AB].

   a) Using the points of the figure, complete $\vec{CA} + \vec{CB} = ...$ (½ pt)

   b) Let $G\left(\frac{2}{3};-\frac{2}{3}\right)$, calculate the coordinates of I, then prove that the points C, G, and I are collinear. (1 ½ pts)

   c) Using the coordinates of the points C, G and I, show that $\vec{GI} = \frac{1}{3}\vec{CI}$. What can you deduce about the point G? (1½pts)

4th exercise: (6pts)

Consider a circle (σ) of center O and diameter [BC] such that BC = 10cm. Let A be a variable point of (σ) distinct of B and C. The perpendicular issued from A to (BC) cuts [BC] at H and the circle (σ) at D such that BD < AC.

1) Draw a figure. (½ pt)
2) a) Show that the two triangles HBD and HAC are similar and write the ratio of similarity. (1pt)

   b) Verify that the triangle HAC is an enlargement of triangle HBD where the center of enlargement is to be determined. (¾ pt)
3) **(AB) and (CD) meet at E.**

   a) Is the quadrilateral ABDC cyclic? Justify. (½ pt)

   b) Show that $E\hat{B}D = A\hat{C}D$. (¾ pt)

   c) Show that the 2 triangles EBD and EAC are similar then show that EB × CA = EC × BD. (1pt)
4) Let M be the point defined by $\vec{CM} = \vec{AB} + \vec{AC}$.

   a) Locate the point M. (1pt)

   b) Show that $\vec{CM} = 2\vec{AO}$ then determine the locus of the point M as A describes the circle (σ).(1½ pts)