ليسه دي زار **الشهادة المتوسطة** التجربة الثالثة لعام 2014 - 2015

مسابقة في الرياضيات الانكليزي	المدّة : ساعتان	الإسم :	الرقم :

إرشادات عامة:
- يسمح بإستعمال آلة حاسبة غير قابلة للبرمجة.
- يمكن الإجابة على المسائل بالترتيب االذي تريد.
- يرجى الإجابة بخط واضح ومرتب.
- العلامة القصوى من 30

1st exercise: (5¼ pts)

In the following table, only one of the proposed answers to each question is correct. Write the number of each question and the corresponding answer, and **justify**.

No.	Questions	Answers A	Answers B	Answers C
1.	If α is an acute angle such that $\sin\alpha = \frac{2-\sqrt{3}}{3}$, then $\cos\alpha =$ …….. **(1 pt)**	$\frac{\sqrt{2+4\sqrt{3}}}{3}$	$\frac{2\sqrt{2}}{3}$	$\frac{\sqrt{2-4\sqrt{3}}}{3}$
2.	If in an orthonormal system of axes the point $M(m-1,n+2)$ belongs to the straight line $(D): y=3x-11$, which makes an acute angle α with the positive $x-axis$ such that $\tan\alpha = m+2n$, then……. **(1 pt)**	$m=1$ & $n=-5$	$m=-5$ & $n=-1$	$m=5$ & $n=-1$
3.	In triangle ABC, consider the points M and N such that $\overrightarrow{AM} = \overrightarrow{BC}$ and $\overrightarrow{AN} = \overrightarrow{AB} + \overrightarrow{AC}$, then………… **(1¼ pts)**	M is the midpoint of $[BC]$	C is the midpoint of $[MN]$	N is the midpoint of $[BC]$
4.	If $M(x,y)$ belongs to $(D): 2y-3x+4=0$ where x & y are proportional to 2 & 5 respectively, then …………**(1 pt)**	$x=-2$ and $y=-5$	$x=2$ and $y=5$	$x=-2$ and $y=5$
5.	The inequality: $(x^2+1)(-x+3)>0$ is satisfied for $x \in$ … **(1 pt)**	$]-\infty,3[$	$]3,\infty[$	$]-\infty,-3]$

2nd exercise: (13¾ pts)

In the orthonormal system of axes $(x'Ox \,\&\, y'Oy)$ where the unit of length is *cm*, consider the points $A(3;0)$, $C(3;8)$, $E(-1;0)$, $B(-3;2n-5)$ and the straight lines $(d): y=2x+2$ and $(\Delta): 4y-x=29$

(n is a real parameter)

Part A:

1) Prove that C is the point of intersection of the two straight-lines (d) and (Δ). **(1 pt)**
2) Plot the points A, E and C then draw (d) and (Δ). **(1½ pts)**
3) a. Using the **properties of the coordinates,** prove that triangle ACE is right. **(1 pt)**

   b. Using the slope of the straight-line (CE), calculate the angles of triangle ACE. **(1¼ pts)**
4) a. Determine graphically the coordinates of $\overrightarrow{CE}$. **(Leave the traces on the figure) (¾pt)**

   b. The straight line (Δ') is the image of (Δ) by the translation of vector $\overrightarrow{CE}$. Draw (Δ'). **(¾pt)**

   c. Determine the equation of (Δ'). **(1pt)**
5) a. On which straight line does the point B vary? **Justify. (¾pt)**

   b. Calculate the coordinates of each of the vectors: $\overrightarrow{CE}$ and $\overrightarrow{CB}$. **(1pt)**

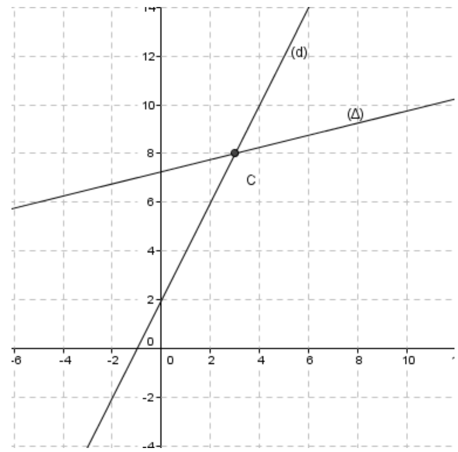
c. Using the coordinates of vectors $\overrightarrow{CE}$ and $\overrightarrow{CB}$, calculate the numerical value of n, so that the points C, E and B are collinear.

Part B:

In this part, you are given the orthonormal system that you have drawn in part A **(you can solve this part without depending on part A)**. Consider the point D, intersection point of (d) with the ordinate axis and let P be a variable point on (d) such that **C is between P and D.**

The perpendicular drawn from P to (d) cuts (Δ) at Q.

(PH) is the height relative to [DQ] in the right triangle PDQ such that ***PD = 4x - 16*** and ***PQ = 3x – 12, where x > 4.***



1) Place the points D, Q and H on your own figure. **(½ pt)**
2) Prove that the area of triangle PDQ is $A(x) = 6(x-4)^2$. **(1 pt)**
3) Prove that $DQ = 5(x-4)$, then deduce that $PH = \frac{12}{5}(x-4)$. **(1¼ pts)**
4) If $A(x) = 54$, then calculate the length of $[PD]$. **(1 pt)**

3rd exercise: (4 pts)

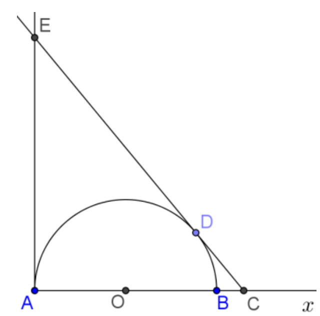
The following study is made to record the number of supplementary exercises performed by each 9th grade student in math per week. The results are organized in the table below:

Number of supplementary exercises per week	1	2	3	4	6
Number of students	5	y	7	x	3
Increasing cumulative frequency (I.C.F)	5				25

1) Determine the population and the character under study then precise its nature. **(¾pt)**
2) Determine the number of students in this class. **Justify. (½ pt)**
3) Interpret the meaning of x in the above table. **(½ pt)**
4) a) Find a relation between x and y. **(½ pt)**
   b) Show that if the average number of extra exercises done by the students is 3.2, then x = 8 and y =2. **(1 pt)**
5) Set up the table of increasing cumulative frequency in percentage and interpret any value. **(¾ pt)**

4th exercise: (7 pts)

- (C) is a semi-circle of center O, radius R=3 cm and of diameter [AB].
- C is a point on the semi straight-line [Ox) passing through B exterior to the semi-circle (C) such that BC = 2cm.
- The tangent to the semi- circle (C) through the point C cuts (C) in D.
- The perpendicular through A to [AB] cuts (CD) in E.



1) Draw a figure. **(½ pt)**
2) Show that the triangles BCD and ACD are similar. **(1 pt)**
3) The perpendicular to [AB] through O, cuts (CE) in F.
   a. Use $\cos(\widehat{OCD})$ in 2 convenient right triangles to calculate FD. **(1½ pts)**
   b. If $OF = \frac{15}{4}cm$, then use Thales' property to calculate EF. **(¾ pt)**
   c. Deduce that [EO) is the bisector of the angle $\widehat{AEC}$. **(¾ pt)**
4) a. Prove that the triangles OFD & ACE are similar, and deduce the ratio of similitude. **(1 pt)**
   b. Prove that the ratio of similitude: $k = \frac{DF}{AE} = \frac{3}{8}$. **(½ pt)**
5) Determine the locus of the point M, the midpoint of [OE], as C varies on [Bx). **(1 pt)**