إرشادات عامة: ـ يسمح باستعمال آلة حاسبة غير قابلة للبرمجة أو اختزان المعلومات أو رسم البيانات.

ـ يستطيع المرشح الإجابة بالترتيب الذي يناسبه دون الالتزام بترتيب المسائل الواردة في المسابقة.

عدد المسائل: خمسة

مسابقة في مادة الرياضيات

المدة: ساعتان

(باللغة الإنكليزية)

الاسم:...

الرقم:...

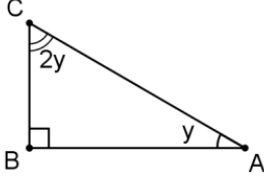## I - (3 points)

In the table below, only one of the proposed answers to each question is correct.
Write down the number of the question and give, **with justification**, its corresponding answer.

Nº	Questions	Proposed answers		
		a	b	c
1	A car costs **15 000 000 LL**. After a reduction of 11%, its price becomes	1 650 000 LL	13 350 000 LL	16 650 000 LL
2	If $\left(\sqrt{2}-1\right)x = 1$ then $x =$	$\sqrt{2}$	1	$\sqrt{2}+1$
3	n is a non-zero real number, $\dfrac{n}{2} - \dfrac{n}{2} \times 3 =$	3	$-n$	0
4	**ABC** is a **right triangle** at **B** such that : $BAC = y$ and $BCA = 2y$ where y is a real number. The value of $\cos BAC$ is	$\dfrac{1}{2}$	$\dfrac{\sqrt{2}}{2}$	$\dfrac{\sqrt{3}}{2}$

II - (3.5 points)

Given $A(x) = 2x^2 - 6x - (x-3)(x-1)$.

1) a. Show that $A(x) = (x+1)(x-3)$.

   b. Solve the equation $A(x) = 0$.

2) Verify that $A(x) = x^2 - 2x - 3$.

3) The grades of students, in mathematics, are given in the following table. (x *is a natural number*)

Grades	4	9	12	19	Total
Number of students	1	x^2	x	1	$x^2 + x + 2$

Calculate x, knowing that the average (mean) of the grades is 10.

III - (3 points)

1) Solve, showing all the steps of calculation, the following system: $\begin{cases} x - 2y = 0 \\ 3y - x = 6. \end{cases}$

2) In a class, the number of boys is double that of girls.

If 2 girls leave the class, the number of boys becomes triple that of the girls.

The teacher confirms that there are 18 students in this class. Is he right? Justify.

IV - (5.5 points)

In an orthonormal system of axes x'Ox and y'Oy,
given the points $F(0\,;4)$ and $B(-2\,;2)$.
Let (d) be the line with equation $y = x + 4$.

1) Plot the points F and B.

2) Show that F and B are two points on (d), then draw (d).

3) Let H be the point of coordinates $(-1\,;3)$.

a. Verify that H is the midpoint of [BF].

b. Show that the equation of (d'), the perpendicular bisector of [BF],
is $y = -x + 2$.

4) a. Show that (OB) and (d') are parallel.

b. Show that the triangle OBF is right isosceles at B.

5) Let (C) be the circle circumscribed about triangle OBF.

Show that the point $E(0\,;2)$ is the center of circle (C), and calculate its radius.

6) Let K be the point of coordinates $(2\,;2)$ and $L(2\,;0)$ the point of intersection of
(d') and x'Ox.

Show that K is a point of circle (C), and that (LK) is tangent to circle (C).

V - (5 points)

In the adjacent figure:

- (C) is a semicircle with center O, diameter [AB] and radius 2 cm.

- F is a point on (C) so that BF = 2 cm.

- E is the symmetric of O with respect to B.
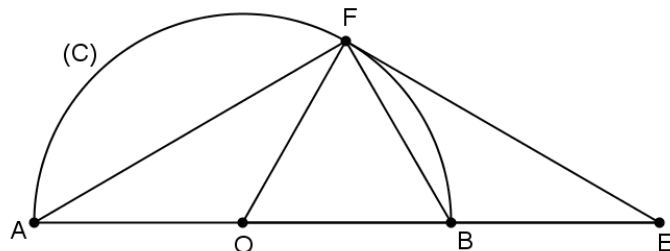
1) Reproduce the figure.

2) Verify that $AF = 2\sqrt{3}$ cm.

3) Show that (EF) is tangent to (C).

4) Let L be the midpoint of [OB]. Show that (FL) is perpendicular to (OB).

5) T is the point so that $\overrightarrow{FT} = \overrightarrow{LE}$.

The parallel through T to (OF) intersects [EF] at R and [LE] at G.

a. Show that (TG) is perpendicular to (EF).

b. Show that the two triangles FLE and GRE are similar.

c. Deduce that $\dfrac{EG}{ER} = \dfrac{2\sqrt{3}}{3}$.

إرشادات عامة: ـ يسمح باستعمال آلة حاسبة غير قابلة للبرمجة أو اختزان المعلومات أو رسم البيانات.

ـ يستطيع المرشح الإجابة بالترتيب الذي يناسبه دون الالتزام بترتيب المسائل الواردة في المسابقة.

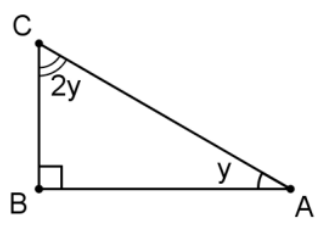**عدد المسائل: خمسة**

مسابقة في مادة الرياضيات

المدة: ساعتان

(باللغة الإنكليزية)

الاسم:.....................................

الرقم:.....................................

I - (3 points)

Verify that the answers to the following questions are correct

Nº	Questions	Answers
1	A car costs **15 000 000 LL**. After a reduction of 11%, its price becomes	13 350 000 LL
2	If $\left(\sqrt{2}-1\right)x = 1$ then $x =$	$\sqrt{2}+1$
3	n is a non-zero real number, $\dfrac{n}{2} - \dfrac{n}{2} \times 3 =$	$-n$
4	**ABC** is a **right triangle** at **B** such that : $BAC = y$ and $BCA = 2y$ where y is a real number. The value of $\cos BAC$ is	$\dfrac{\sqrt{3}}{2}$

II - (3.5 points)

Given $A(x) = 2x^2 - 6x - (x-3)(x-1)$.

1) a. Show that $A(x) = (x+1)(x-3)$.

   b. Solve the equation $A(x) = 0$.

2) Verify that $A(x) = x^2 - 2x - 3$.

3) The grades of students, in mathematics, are given in the following table.

   (x *is a natural number*)

Grades	4	9	12	19	Total
Number of students	1	x^2	x	1	$x^2 + x + 2$

   a. Show that the average is written in the form $\overline{x} = \dfrac{9x^2 + 12x + 23}{x^2 + x + 2}$

   b. Calculate x, knowing that the average (mean) of the grades $\overline{x}$ is 10.

III - (3 points)

1) Solve, showing all the steps of calculation, the following system: $\begin{cases} x - 2y = 0 \\ 3y - x = 6. \end{cases}$

2) In a class:

- The number of boys is double that of girls.

- If 2 girls leave the class, the number of boys becomes triple that of the girls.

a. Let x be the number of boys and y the number of girls

Show that the previous informations can be translated by the given system in question 1).

b. Determine the number of students of this class

IV - (5.5 points)

In an orthonormal system of axes x'Ox and y'Oy,

Given the points $F(0;4)$ and $B(-2;2)$.

Let (d) be the line with equation $y = x + 4$.

1) **Plot** the points F and B.

2) **a. Show that** F and B are two points on (d)

   b. Draw the line (d).

3) Let H be the point of coordinates $(-1;3)$.

   a. Verify that H is the midpoint of [BF].

   b. Show that the equation of (d'), the perpendicular bisector of [BF],

      is $y = -x + 2$.

4) **a. Show that** (OB) and (d') are parallel.

   b. Show that (OB) is perpendicular to (BF).

   c. Calculate BO and BF

   d. Deduce that the triangle OBF is right isosceles at B.

5) Let (C) be the circle circumscribed about triangle OBF.

   a. Show that the point $E(0;2)$ is the center of circle (C).

   b. Calculate its radius.

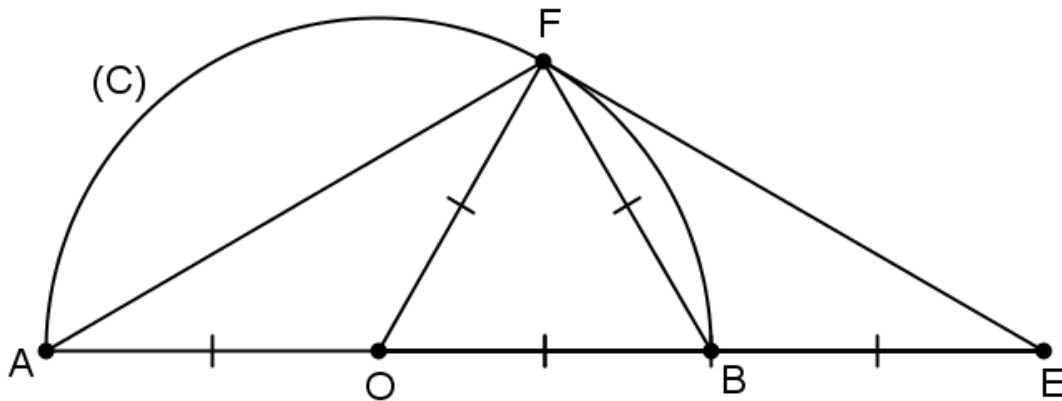6) Let K be the point of coordinates $(2;2)$ and $L(2;0)$ the point of intersection of (d') and x'Ox.

   a. Show that K is a point of circle (C).

   b. Show that (LK) is tangent to circle (C).

V - (5 points)

In the figure below:

• (C) is a semicircle with center O, diameter [AB] and radius 2 cm.

• F is a point on (C) so that BF = 2 cm.

• E is the symmetric of O with respect to B.

1) **Reproduce** the figure.

2) **Verify that** $AF = 2\sqrt{3}$ cm using the triangle AFB.

3) **Show that** OEF is a right triangle at F.

4) Let L be the midpoint of [OB].

   Show that (FL) is perpendicular to (OB).

5) Let T be the fourth vertex of the rectangle FLET.

   The parallel through T to (OF) intersects [EF] at R and [LE] at G.

   a. Show that (TG) is perpendicular to (EF).

   b. Show that the two triangles FLE and GRE are similar.