مسابقة في مادة الرياضيات الاسم: عدد المسائل: ستة المدة ساعتان ال دقد:

ارشادات عامة : ـ يسمح باستعمال آلة حاسبة غير قابلة للبرمجة او اختزان المعلومات او رسم البيانات. ـ يستطيع المرشح الإجابة بالترتيب الذي يناسبه دون الالتزام بترتيب المسائل الوارد في المسابقة .

I- (2 points)

In the following table, only one of the proposed answers to each question is correct.

Write the number of each question and its corresponding answer. Justify your choice.

N°	Questions	Proposed answers				
11	Questions	a	b	С		
1	If $\left(x + \frac{1}{x}\right)^2 = 15$ then $x^2 + \frac{1}{x^2} =$	225	13	$\sqrt{15}$		
2	n is a natural number $ \left(\frac{4}{5}\right)^{n+1} \times \left(\frac{5}{4}\right)^{n} = \dots $	8×10 ¹	1 ²ⁿ⁺¹	8×10 ⁻¹		
3	In an orthonormal system, the two lines (D_1) : $y = (2 - \sqrt{5})x - 5$ and (D_2) : $y = (2 + \sqrt{5})x + 5$ are	parallel	perpendicular	intersecting at B(0; 5)		
4	(ME) and (NF) are two parallel lines, then $\frac{NF}{ME} = \dots$ A E F	AN AM	$\frac{AE}{AF}$	AN MN		

II- (2 points)

Given:
$$A = \frac{8}{3} - \frac{5}{3} \times \frac{21}{15}$$
; $B = \frac{3.4 \times 10^{-3} \times 5 \times (10^2)^3}{4 \times 10^{-3}}$ and $C = \frac{(1 - \sqrt{3})^2}{(2 + \sqrt{3})^2}$.

Show all the details of the following:

- 1) Calculate A and write the answer as a fraction in the simplest form.
- 2) Calculate B and write the answer in scientific notation.
- 3) Write C in the form $a b\sqrt{3}$ where a and b are two integers.

III- (3 points)

An agency for renting cars proposes to its customers the following two offers A and B:

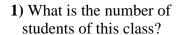
Deposit Charge per k		Charge per km
Offer A	50 000 LL	600 LL
Offer B	42 000 LL	700 LL

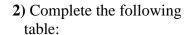
Denote by x the number of kilometers traveled by a car that a customer rents.

- 1) Find in term of x, the amount S paid by this customer if he selects the offer A, and the amount S' if he selects the offer B.
- 2) Calculate x so that S is equal to S'.
- 3) Starting what traveled distance is the offer A more advantageous than the offer B? justify.
- 4) A second customer selects offer A and pays 410 000 LL. What is the traveled distance by this customer?

IV- (3 points)

The adjacent graphic represents the cumulative frequency polygon of the students' grades in a certain class.





24 22 20 14 11

13

15

17 18

Grades

Grades	8	9	10	13	15	17	18
Cumulative frequency	3	5					
Frequency	3	2					

8 9 10

Cumulative frequency

- 3) Write as percent the relative frequency of grade 10.
- 4) What is the average grade of the students of this class?

V- (5 points)

In an orthonormal system of axes, x'Ox and y'Oy, consider the line (D) with equation y = -2x-3 and the two points A (-2; 1) and B (6; 5).

- 1) Verify that (D) passes through A.
- 2) Plot A and B and draw (D).
- 3) Determine the equation of (AB) and deduce that (D) is perpendicular to (AB).

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- **4**) Calculate, rounded to the nearest degree, the value of the acute angle that (AB) makes with x'Ox .
- 5) The line (D) intersects y'Oy at C. Find the coordinates of C.
- **6)** Let (S) be the circle circumscribed about the triangle ABC. I is the center of this circle. Calculate the coordinates of I.
- 7) The line (D') is the parallel through C to (AB). (D') intersects the circle (S) at another point E.
 - **a.** What is the nature of the quadrilateral ABEC? Justify.
 - **b.** Calculate the coordinates of the point E.
 - **c.** (d) is the tangent at A to (S). Find the equation of (d).

VI- (5 points)

ABE is an isosceles triangle with vertex B, and so that BE = BA = 6 cm and $ABE = 140^{\circ}$. The circle (C) with diameter [BE] and center O intersects (AB) at another point F.

- 1) Make a figure.
- 2) What is the nature of the triangle BEF? Justify.
- 3) I is the midpoint of [AE]. Show that I is a point on (C).
- 4) a. Calculate BAE and EBF.
 - **b.** Find to the nearest thousandth an approximate value of BF.
- 5) Prove that the two triangles ABI and AEF are similar, and deduce that $AB \times AF = 2 \times AI^2$.
- **6)** G is the translate of E under the translation with vector \overrightarrow{FB} .
 - **a.** Show that EFBG is a rectangle but not a square.
 - **b.** Prove that G, O and F are collinear.

N11		11 1
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Answer the six following exercises:

First exercise (2 points)

FIISU	exercise (2 points)	
Part of the Q	Answer	Mark
1	$(x + \frac{1}{x})^2 = x^2 + \frac{1}{x^2} + 2 = 15$ therefore $x^2 + \frac{1}{x^2} = 13$ (b).	0.50
	$\left(\frac{4}{5}\right)^{a+1} \times \left(\frac{5}{4}\right)^{a} = \frac{4^{1}}{5^{1}} = \frac{4}{5} = 0,8 = 8 \times 10^{-1} \text{ (c)}.$	0.50
3	$a \times a' = (2 - \sqrt{5})(2 + \sqrt{5}) = 4 - 5 = -1.$ therefore (D ₁) and (D ₂) are perpendicular. (b).	0.50
4	Using Thalès: $\frac{NF}{ME} = \frac{AN}{AM}$. (c).	0.50

Second exercise (2 points)

Second exercise (2 points)					
Part of the Q	Answer	Mark			
1	$A = -\frac{5}{3}.$	0.50			
2	$B = 4 \times 10^5 = 0.4 \times 10^6.$	0.75			
3	$C = \frac{\left(4 - 2\sqrt{3}\right)\left(7 - 4\sqrt{3}\right)}{49 - 48} = 52 - 30\sqrt{3}.$	0.75			

Third exercise (3 points)

	exercise (3 points)									I
Part of	Answer							Mark		
the Q		. 24								0.50
1	The number of the students			1	1	1	T		1	0.50
2	Cumulative frequency	8	9	10	13	15	17	18		1.50
4	Grades	3	5	6	3	6	2	2		1.50
3	$\frac{2}{24} \times 100 = \frac{25}{3}$, then $\frac{25}{3}$ %	•								0.50
	The average grade \overline{X} :									
4	$\overline{X} = \frac{(8 \times 3) + (9 \times 2) + (10 \times 6) + (13 \times 3) + (15 \times 6) + (17 \times 2) + (18 \times 2)}{24}$									0.50
-	- ·									
	$\overline{X} = \frac{301}{24} \approx 12.54.$									

Fourth exercise (3 points)

Part of	Answer	Monk
the Q	Allswei	Mark

1	S = 50000 + 600x ; $S' = 42000 + 700x$	1
2	S = S' then $x = 80$. The traveled distance is 80 km.	0.50
3	S < S' then $x > 80$; the offer A is better than B for every distance greater than 80 km.	0.75
4	$410000 = 50000 + 600 \text{ x} \qquad \text{x} = 600.$	0.75

Fifth exercise (5 points)

Part of the Q	Answer	Mark
1	Fig.	1.25
2	The coordinates of A verify the equation (D)	0.5
3	$a_{(AB)} = \frac{y_B - y_B}{x_B - x_A} = \frac{4}{8} = \frac{1}{2} \text{, where the equation of (AB)} : y = \frac{1}{2}x + 2.$ (D) is perpendicular (AB) (product of the slopes equals -1)	1
4	C = (0;-3)	0.25
5	I (3;1)	0.5
6.a	ABEC is a rectangle since	0.5
6.b	E (8;1)	0.5
7	$\alpha = \tan^{-1} \frac{1}{2} = 27^{\circ}$	0.5

Sixth exercise (5 points)

Part of the Q	Answer	Mark
1	La figure: B O (C)	0.50
2	BEF is right at F.	0.50
3	(BI) \perp (AB), then $\stackrel{\square}{B}$ IE = 90°. Hence I is on (C).	0.75
4.a	$ABE = 180^{\circ} - 40^{\circ} = 140^{\circ}$; $EBF = 40^{\circ}$.	0.50
4.b	EBF is right at F, $\cos EBF = \frac{BF}{BE}$ BF = $6 \times \cos 40^{\circ}$; BF ≈ 4.596 .	0.75
4.c	$EF^2 = BE^2 - BF^2$, $EF \approx 3.8$ (Or : $EF = BE \times \sin 40^\circ$).	0.50
5.a	EFBG is a parallelogram and $BFE = 90^{\circ}$, then it is a rectangle. Moreover EF \neq BF, then it is not a square.	0.75
5.b	[GF] is a diagonal of the rectangle EFBG, then O is the midpoint of [GF].	0.75