عدد المسائل: ستة | مسابقة في مادة الرياضيات | الاسم:
المدة: ساعتان | الرقم:

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

I- (2 points)

The questions 1), 2) and 3) are independent of each other.

1) Write the following expression in the form of a decimal fraction, showing the steps of your calculation: $\dfrac{-2.4\times 5^2+3(9.3-4.3)^2}{2\times 2.5\times 60}$.

2) Given that $a=\dfrac{3}{2}$, $b=\dfrac{3}{4}$ and $c=\dfrac{4}{5}$. Calculate $(b-a)$, $(a-bc)$ and $\dfrac{ac}{b}$.

3) x is a natural integer:

a. Write in terms of x the natural integer which is just before x and the integer that is just after x.

b. Calculate the product of these three natural integers in terms of x .

c. Use the above result to calculate: $9\times 10\times 11$.

II- (3 points)

1) Consider the polynomial $P(x) = a\,x^2 - 4(x + 5)$.

a. Calculate a such that -2 is a root of $P(x)$.

b. Let $E(x) = 4(x^2 - 4) - (x + 2)^2$; verify that $E(x) = 3\,x^2 - 4x - 20$.

c. Factorize $E(x)$.

d. Solve the equation $E(x) = 0$.

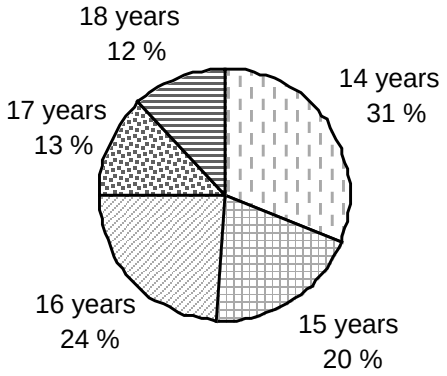
2) Suppose that $x = 2\sqrt{2} + 1$

a. Calculate x^2 and $2x + 7$, and then compare the two numbers obtained.

b. Verify that $x - 2 = \dfrac{7}{x}$.

III- (2 ½ points)

The 300 students in a school are distributed into 5 categories according to their ages, which are respectively 14,15, 16,17 and 18 years. The circular diagram below shows the percentage frequencies of this distribution.



1) Copy and complete the following table: .

age	14	15	16	17	18	
frequency				39		Total=300
Cumulative frequency						

2) Determine the mean age of these students.

3) Determine the number of students having ages strictly less than 17 years.

IV- (2 points)

A person bought a computer for 1 200 000 LL. He paid one quarter of this price as a down-payment. The remaining amount of the price is to be paid in 10 monthly payments:

Some of these payments are 150 000 LL each, and the others are 50 000 LL each.

Let x be the number of the 150 000 LL payments.

1) Calculate the down-payment, and the remaining amount of the price of this computer.
2) Calculate the number of the 150 000 LL payments, and that of the 50 000 LL payments.

V-(5 ½ points)

Consider a circle (C) with center O, diameter [AB] and radius 3 cm.
(d) is the tangent at A to (C) and F is a point on (d) such that AF = 4 cm.
E is the orthogonal projection of A on (OF). (AE) cuts again (C) at a point L.

1) **a.** Draw a figure.

b. Calculate OF and $\cos \widehat{OFA}$.

2) **a.** Show that the two triangles OAF and BLA are similar. Write the similarity ratio.

b. Use this ratio to calculate BL and AL.
Deduce OE and AE.

3) (LO) cuts again (C) at K, and (BK) meets (d) at S.

a. Determine the nature of quadrilateral BLAK.

b. Compare $\widehat{SAK}$ and $\widehat{ABK}$.

c. Determine $\cos \widehat{SAK}$ in the triangle SAK, then calculate AS.

d. Express the cosine of the angle $\widehat{B}$ in each of the two right triangles ABK and ABS, then deduce the relation $AB^2 = BK \times BS$.

VI- (5 points)

In the orthonormal system of axes x'Ox, y'Oy , given the two lines:

(D_1) of equation $y = 3x + 6$ and (D_2) of equation $y = -\frac{x}{3} + 3$.

1) Plot the two lines (D_1) and (D_2).

2) Prove that (D_1) and (D_2) are perpendicular.

3) The two lines (D_1) and (D_2) intersect at A. Calculate the coordinates of the point A.

4) Plot the point C(9;0) and show that C is on (D_2).

5) (D_1) cuts x'Ox at a point B. Calculate the coordinates of B.

6) Let E be the point of intersection of (D_1) and y'Oy.

a. Find the coordinates of the point E.

b. Calculate the coordinates of the center M of the circle circumscribed about the triangle AEC.

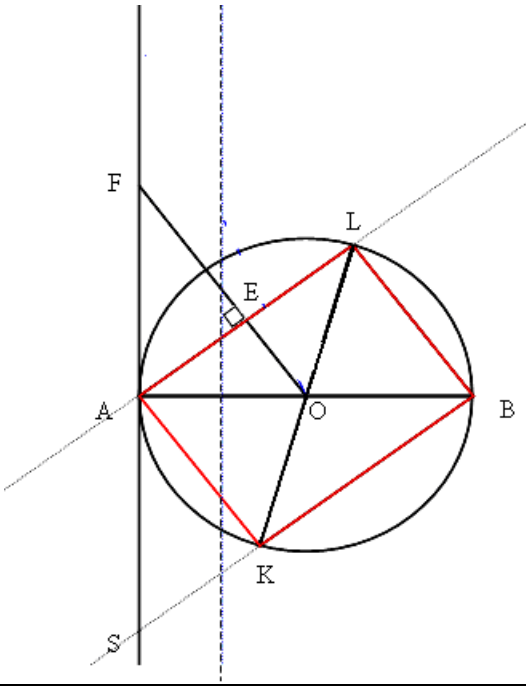
c. Find an equation of the straight line (Δ) the translate of (D_2) under the translation with vector $\overrightarrow{AE}$.

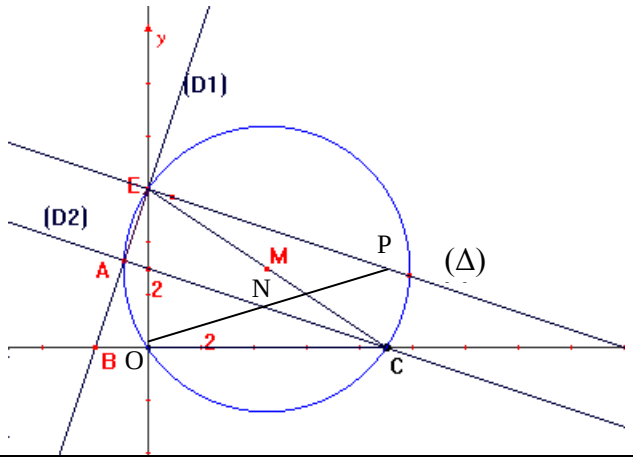
d. Let P be a variable point on (D_2), and let N be the symmetric of O with respect to P.
Determine the locus of N.

مشروع معيار التصحيح

مسابقه في مادة الرياضيات
المدة: ساعتان

الاسم:
الرقم:

Part of Q.		Answer	Mark
I	1	$\frac{5^2(3-2,4)}{5\times 60}=\frac{0,6}{2\times 6}=\frac{1}{20}$	0.50
	2	$b-a=\frac{-3}{4}$; $a-bc=\frac{9}{10}$ and $\frac{ac}{b}=\frac{8}{5}$.	0.75
	3.a	The integer before x is $(x-1)$,and that after x is $(x+1)$	0.25
	3.b	$(x-1)\times x\times(x+1)=x^3-x$	0.25
	3.c	$9\times 10\times 11=1000-10=990$.	0.25
II	1.a	$a=3$.	0.25
	1.b	$E(x)=4x^2-16-x^2-4x-4=3x^2-4x-20$.	0.50
	1.c	$E(x)=(x+2)(4x-8-x-2)=(x+2)(3x-10)$	0.75
	1.d	$x=-2$ or $x=\frac{10}{3}$.	0.50
	2.a	$x^2=9+4\sqrt{2}$ and $2x+7=9+4\sqrt{2}$.	0.50
	2.b	$2\sqrt{2}+1-2=\frac{7}{2\sqrt{2}+1}$; $(2\sqrt{2}-1)(2\sqrt{2}+1)=7$	0.50
III	1	Age | 14 | 15 | 16 | 17 | 18 | frequency | 93 | 60 | 72 | 39 | 36 | 300 Cumulative frequency | 93 | 153 | 225 | 264 | 300 |	1.75
	2	Mean age $=\frac{14\times 93+15\times 60+16\times 72+17\times 39+18\times 36}{300}=\frac{4665}{300}=15,55$.	0.50
	3	The number of students who are younger than 17 is 225.	0.25
IV	1	$\frac{1}{4}\times 1200000=300\,000$ LL the remaining amount is 900 000 LL	0.75
	2	The 150 000LL payments are 3, and the 50 000LL are 6.	1.25
V	1.a	See the figure 	0.50
	1.b	$OF^2=OA^2+AF^2=25$, thus OF = 5 cm. $\cos\widehat{OFA}=\frac{AF}{OF}=\frac{4}{5}$.	0.50
	2.a	$\widehat{OAF}=\widehat{BLA}=90^o$.	1

		(OF) // (BL), then $\widehat{ABL} = \widehat{AOF}$ (corresponding angles). Therefore OAF and BLA are similar by (AA). Similarity ratio : $\frac{OA}{BL}=\frac{OF}{BA}=\frac{AF}{LA}$.	
	2.b	$\frac{3}{BL}=\frac{5}{6}$, then BL = $\frac{18}{5}$ cm ; $\frac{5}{6}=\frac{4}{AL}$, then AL = $\frac{24}{5}$ cm. OE = $\frac{1}{2}$BL = $\frac{9}{5}$ cm ; and AE = $\frac{1}{2}$AL = $\frac{12}{5}$ cm.	**1**
	3.a	BLAK is a rectangle.	**0.50**
	3.b	$\widehat{SAK} = \widehat{ABK} = \frac{1}{2}\widehat{AK}$.	**0.50**
	3.c	In the triangle SAK, cos $\widehat{SAK} = \frac{AK}{AS}=\frac{4}{5}$; $AS=\frac{9}{2}$	**0.75**
	3.d	cos $\widehat{ABK}=\frac{AK}{AB}$; cos $\widehat{ABS}=\frac{AB}{BS}$ so $\frac{AK}{AB}=\frac{AB}{BS}$ then AB^2 = AK × BS.	**0.75**
VI	**1**	(D_1) : y = 3x + 6. (D_2) : y = $-\frac{x}{3}$ + 3. x | 0 | 1 y | 6 | 9 x | 0 | 3 y | 3 | 2 	**1**
	2	The slope of (D_1) is a = 3, and the slope of (D_2) is a'= $-\frac{1}{3}$, therefore a×a' = – 1 therefore $(D_1) \perp (D_2)$	**0.50**
	3	(D_1) and (D_2) intersect at A. Therefore the coordinates of A are the solution of the system : $\begin{cases} y=3x+6 \\ y=-\frac{x}{3}+3 \end{cases}$, therefore y = y , hence A($-\frac{9}{10};\frac{33}{10}$)	**0.50**
	4	C(9,0) and (D_2) ; y= $-\frac{x}{3}$ + 3 ; 0 = $-\frac{9}{10}$ + 3, hence C belongs to (D_2).	**0.25**
	5	B (– 2 ; 0)	**0.25**
	6.a	E (0 ; 6)	**0.25**
	6.b	ACE is a right triangle at A, the center M of the circle circumscribed around this triangle is the midpoint of [EC] , therefore M ($\frac{9}{2}$; 3).	**0.50**
	6.c	$(\Delta)//(D_2)$ by translation , then a = a'=– $\frac{1}{3}$; but (Δ) passes through E(0 ; 6) therefore y = – $\frac{1}{3}$ x + 6.	**1**
	6.d	The locus of P is the line (Δ) .	**0.75**