


المادة: الرياضيات الشهادة: المتوسطة نموذج رقم 3- المدة : ساعتان	الهيئة الأكاديمية المشتركة قسم : الرياضيات	 المركز العلمي للبحوث والابتكار
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نموذج مسابقة (براعي تعليق الدروس والتوصيف المعدل للعام الدراسي ٢٠١٦-٢٠١٧ وحتى صدور المناهج المطورة)

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- (3 points)

Answer « true » or « false » and justify your answer.

- 1) $(-2x - 2)^2 = 4(x + 1)^2$.
- 2) The solutions of the equation $x^2 + 10 = 0$ are $\sqrt{10}$ and $-\sqrt{10}$.
- 3) If x is an acute angle and $\sin x = \frac{1}{3}$, then $\cos x = \frac{2}{3}$.
- 4) The equation $(x + 3)^2 = 0$ has no solution.
- 5) If x is a number greater than 3, then $(x^2 + 1)(2x - 5)$ is positive.

II- (2 points)

The questions 1) et 2) are independent. Show all the steps of your work.

1) Given $A = \frac{1}{\sqrt{7+1}} + \frac{1}{\sqrt{7-1}}$ and $B = \frac{7}{3\sqrt{7}}$.

Compare A and B

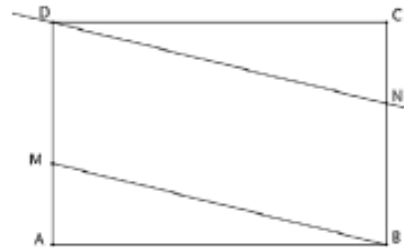
2) a) Verify that: $\frac{4\sqrt{2}+2}{4+\sqrt{2}} = \sqrt{2}$.

b) Use the previous equality to prove that $\frac{(\sqrt{32}+2)^2}{(\sqrt{36-10-\sqrt{2}})^2}$ is a natural number.

III- (4 points)

ABCD is a rectangle such that $AB = 4$ m and $AD = 3$ m.

M is a point on [AD]. The parallel through D to (BM) intersects [BC] at N. Let $AM = x$.



Part A

- 1) Prove that:
 - a) x is less than 3.
 - b) DMBN is a parallelogram.
 - c) $NC = x$.
- 2) Prove that the area of the square with side DM is $(3 - x)^2$.
- 3) Prove that the area of the parallelogram DMBN is equal to $12 - 4x$.

Part B

- 1) Factorize $S' - S$.
- 2) Can you find x so that the two areas are equal?
- 3)
 - a) Solve the equation $(x+1)(3-x) = 3$.
 - b) Give a geometric interpretation to the result.

IV- (2 points)

The sum of two numbers is 47. When we divide one of the numbers by 2 and the other by 3, the sum becomes 17.5.

- 1) Which one of these 3 systems is related to the given?

$$\begin{cases} x + y = 47 \\ 3x + 2y = 17,5 \end{cases} \quad \begin{cases} y = 47 - x \\ 3x + 2y = 105 \end{cases} \quad \begin{cases} x + y = 47 \\ \frac{x + y}{2} + \frac{y}{3} = 17,5 \end{cases}$$

- 3) Find the two numbers.

V- (4 points)

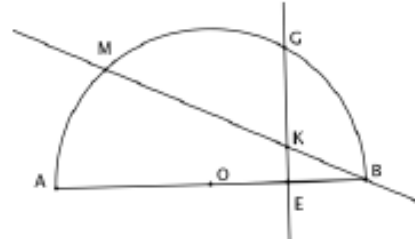
In an orthonormal system of axes $x'Ox$ and $y'Oy$, consider the line (D) with equation $y = 2x - 1$, and the points $B(2 ; 3)$ and $C(3 ; 1)$.

- 1) Draw the line (D) and plot the points B and C.
- 2) Does the line (D) pass through the points B and C? Justify.
- 3) Let (D') be the line with equation $y = -\frac{1}{2}x + \frac{5}{2}$.
 - a) Prove that (D') passes through C and is perpendicular to (D).
 - b) (D') and (D) intersect at S. Determine the coordinates of the point S.
- 4) Determine the coordinates of the point I, centre of the circle circumscribed about the triangle BSC, and determine the length of its radius.
- 5) Determine the coordinates of point A such that BSCA is a parallelogram. Prove that A is a point on the circle circumscribed about BSC.

VI- (5 points)

In the adjacent figure:

- a semicircle with diameter [AB] and center O;
- $AB = 2R$;
- E is midpoint of [OB];
- (GE) perpendicular bisector of [OB] (G is a point on the semicircle);
- K is a point on segment [EG]. The line (BK) and the semicircle intersect at M.



- 1) Draw a figure, to be completed in the remaining parts of the problem.
- 2) a) Prove that the triangle OBG is equilateral.
b) Calculate GE in terms of R.
c) Calculate the angle GMB.
- 3) Prove that the triangles BEK and BMA are similar.
Deduce that $BK \times BM = R^2$.
- 4) The perpendicular through E to (AM) intersects (AM) at N.

Calculate the ratio $\frac{MN}{AM}$

- 5) In this part, suppose that k is the centroid of the triangle GOB.
 - a) Calculate EN and MN in terms of R.
 - b) Find R so that the perimeter of the quadrilateral BMNE is equal to $7\sqrt{3} + 3$