

المادة: الرياضيات الشهادة: المتوسطة نموذج رقم - ١ - المدة : ساعتان	الهيئة الأكاديمية المشتركة قسم : الرياضيات	 المركز التربوي للبحوث والإنماء
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نموذج مسابقة (يراعي 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 - (2 points)

Consider the three numbers A, B and C:

$$A = \frac{33 \times 10^{-4} \times 30 \times 10^2}{36 \times 10^{-2} \times 22 \times 10} ; B = \frac{7 - \frac{11}{3}}{1 - \frac{1}{6}} ; C = (\sqrt{2} - 1)^2 + (\sqrt{2} + 1)^2$$

All details of calculation must be shown.

- 1) Write A as a fraction in its simplest form.
- 2) Show that B is a natural number.
- 3) Verify that $C = B + 16A$.

II – (3 points)

The perimeter of a rectangle is 28cm. If the length is decreased by 10% and the width is increased by 20%, then the perimeter of this rectangle will be 28.8cm.

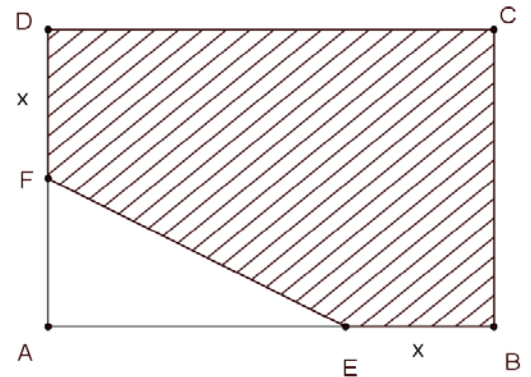
- a) Write a system of 2 equations of 2 unknowns to model the previous text.
- b) Verify that the original length is 8cm and calculate the original width.
- c) Determine the nature of quadrilateral resulting from modification of dimensions of the rectangle.

III – (4 points) in the figure at the right :

- x is a length expressed in cm such that $0 < x < 4$.
- ABCD is a rectangle such that $AB = 6\text{cm}$ and $AD = 4\text{cm}$.
- $BE = DF = x$

Denote by Y the area of the shaded part.

- 1) Prove that $Y = -\frac{1}{2}(x^2 - 10x - 24)$
- 2) a. Verify that $Y = -\frac{1}{2}((x - 5)^2 - 49)$.
b. Determine x so that $y = 20$.
- 3) Z is the area of a square with side $(x+2)$.
a. Express Z in terms of x .
b. Simplify $\frac{Y}{Z}$.
c. Can we calculate x if $Y = Z$?



IV - (5.5 points)

In an orthonormal system of axes $(x'Ox, y'Oy)$, consider the points $A(3; 0)$ and $B(-1; 2)$.

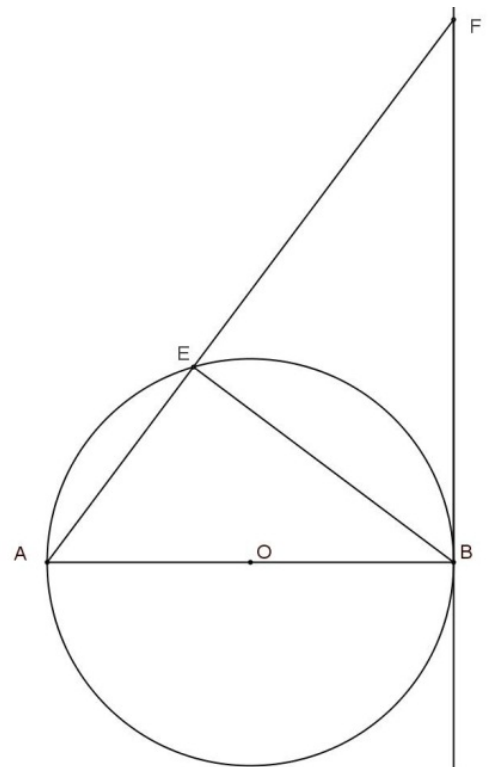
Let (d) be the line with equation $y = 2x + 4$.

- 1) a. Plot the points A and B.
b. The line (d) intersects $x'Ox$ at E and $y'Oy$ at F. Calculate the coordinates of points E and F, then draw (d).

- V- (5.5 points)**

- $AB = 5$ cm.
- (C) is the circle with diameter $[AB]$ and center O.
- E a point on (C) such that $AE = 3$ cm.
- The tangent to (C) at B intersect (AE) at F.

- 4) The line (EO) intersects the circle (C) at H. Let G the midpoint of [BL].
- Prove that EAHB is a rectangle. Deduce that H is on (AL).
 - Prove that (GH) is tangent to (C).
 - Calculate, rounded to the nearest degree, the measure of $\widehat{GHB}$.

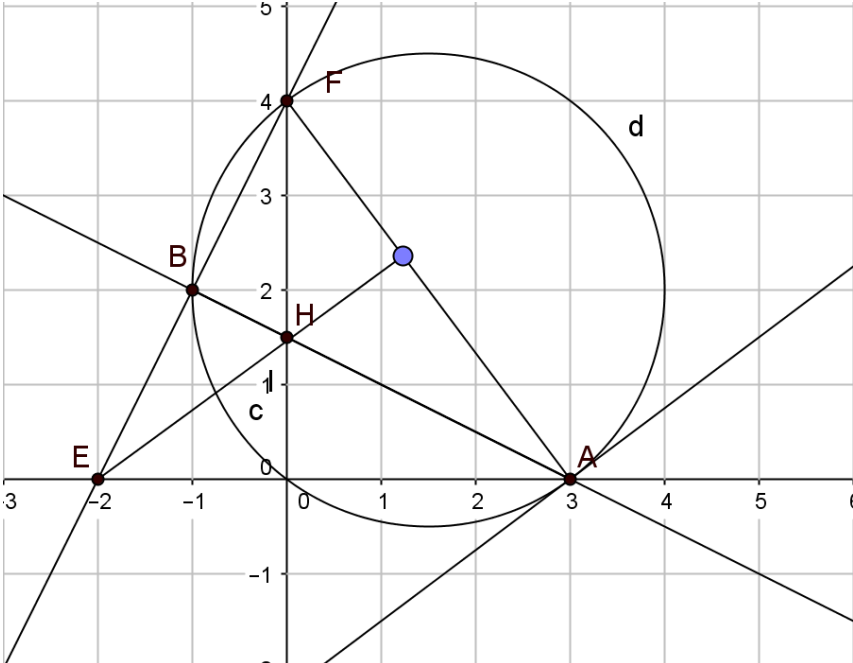


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أسس التصحيح (تراعي تعليق الدروس والتوصيف المعدل للعام الدراسي ٢٠١٦-٢٠١٧ وحتى صدور المناهج المطورة)

Question I		
	Answers	note
1	$A = \frac{33 \times 10^{-4} \times 30 \times 10^2}{36 \times 10^{-2} \times 22 \times 10} = \frac{9 \times 10^{-1}}{72 \times 10^{-1}} = \frac{1}{8} \quad \frac{1}{4} + \frac{1}{4}$ $B = \frac{\frac{3}{5}}{\frac{10}{6}} = 4, \quad \frac{1}{4} + \frac{1}{4}$ $C = (\sqrt{2} - 1)^2 + (\sqrt{2} + 1)^2 = 2 - 2\sqrt{2} + 1 + 2 + 2\sqrt{2} + 1 = 6 \quad \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$	1¾
2	$16A + B = 2 + 4 = 30$ $C = 6$, so $C = B + 16A$.	¼
Question II		
a	$2x + 2y = 28\text{cm}$ $2(1-0,1)x + 2(1+0,2)y = 28,8\text{cm}$	1¼
b	$x=8, y=6$	1
c	$1,2y=7.2$ et $0,9x=7.2$ Therefore the quadrilateral is a square.	¾
Question III		
1	Area of hatched area $Y = 24 - \frac{(4-x)(6-x)}{2} = \frac{-x^2+10x+24}{2} = -\frac{1}{2}(x^2 - 10x - 24)$.	1
2.b	$20 = -\frac{1}{2}((x-5)^2 - 49)$ alors $(x-5)^2 - 49 = -40, (x-5)^2 = 9$ $x-5=3$ or $x-5=-3$ so $x=8$ (unacceptable) ou $x=2$. $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$	1¼
3.a	$Z = (x+2)^2$	¼
3.b	$\frac{Y}{Z} = \frac{-\frac{1}{2}(x-12)(x+2)}{(x+2)^2} = \frac{-\frac{1}{2}(x-12)}{(x+2)} = \frac{-(x-12)}{2(x+2)}$ (with $x \neq -2$)	½
3.c	$Y = Z$ so $\frac{-(x-12)}{2(x+2)} = 1$ then $-(x-12) = 2(x+2)$ so $x = \frac{8}{3}$ acceptable.	1

Question IV

1.a		$\frac{1}{2}$
1.b	E(0;-2) and F(0 ; 4)	$\frac{1}{2}$
1.c	$x_B = \frac{(x_E+x_F)}{2}$ $y_B = \frac{(y_E+y_F)}{2}$	$\frac{1}{2}$
2.a	The equation of (AB) : $y = a x + b$ $a(AB) = \frac{(y_B - y_A)}{(x_B - x_A)} = \frac{-1}{2}$ and $y_B = \frac{-1}{2} x_B + b$ so $b = \frac{3}{2}$.	$\frac{3}{4}$
2.b	slope (AB) $\times$ slope (d) = -1 and (AB) through B middle of [EF] so (AB) is the mediator of [EF].	$\frac{1}{2}$
3.a	$y_H = \frac{-1}{2} x_H + \frac{3}{2}$. so H is a point of (AB)	$\frac{1}{4}$
3.b	(FH) $\perp$ at (EA) and (AB) $\perp$ at (EF) , (AB) and (FH) meet in H then H is the orthocenter of the triangle AEF.	$\frac{3}{4}$
4.a	$\widehat{ABF} = 90^\circ$ (ABF triangle inscribed in a semicircle of diameter [AF]) $\widehat{AOF} = 90^\circ$ (AOF triangle inscribed in a semicircle of diameter [AF]) Therefore B and O are two points of the circle.	$\frac{1}{2}$
4.b	The equation of (Δ) : $y = a x + b$ $a(\Delta) = a(EH) = \frac{(y_E - y_H)}{(x_E - x_H)} = \frac{3}{4}$ and $y_A = \frac{3}{4} x_A + b$ so $b = \frac{9}{4}$.	$\frac{3}{4}$
4.c	(EH) $\perp$ at (FA) and (Δ)//at (EH) then (Δ)$\perp$ at (FA) in A so (Δ) is tangential to the circle (C) in A.	$\frac{1}{2}$

5.b	In the triangle BHL rectangle in H on $HG = GB = GL$ (the median is half the hypotenuse) Then the two triangles OBG and OHG are isometric. $\widehat{GHO} = \widehat{OBL} = 90$ then BH tangent to (C).	$\frac{1}{2}$
5.c	$\cos \widehat{GBH} = \frac{BH}{BL} = \frac{\frac{3}{4}}{\frac{15}{4}} = \frac{4}{5}$ Alors $\widehat{GBH} = \cos^{-1}\left(\frac{4}{5}\right) = 36,8^\circ \approx 37^\circ$	$\frac{1}{2}$