

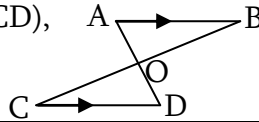
إرشادات عامة:

- يسمح باستعمال آلة حاسبة غير قابلة للبرمجة
- يمكن الإجابة على المسائل بالترتيب الذي تريد
- يرجى الإجابة بخط واضح ومرتب
- العلامة القصوى من 30
- عدد المسائل: 5

1st exercise: (6pts)

In the table below, only one of the proposed answers to each question is correct. Write the number of each question and the corresponding answer and justify.

No.	Questions	Answers		
		a	b	c
1.	Given the polynomial $P(x) = 4x^3 - 4x^2 + x$, then the equation $P(x) = 0$ admits	2 roots as integers	3 roots as integers	1 root as an integer
2.	Given $E = \sqrt{(2 - \pi)^2} - \sqrt{(2\pi - 3)^2} + \sqrt{(10 - 3\pi)^2}$ then $E =$	5	$11 - 4\pi$	$5 + 4\pi$
3.	Given a linear function f such that -2 has an image 9 by f . The image of 3 by f is:	$-\frac{27}{2}$	$\frac{27}{2}$	$\frac{3}{-2}$
4.	A population of bacteria is formed of 1000 bacteria. Knowing that each hour the population increases by 10%, then after 2 hours the number of bacteria is	2200	1210	1300
5.	In the adjacent figure $(AB) \parallel (CD)$, $AB = 6$, $CO = 1$ and $BC = 4$ then $CD =$	2	3	1



2nd exercise: (6 ½ pts)

Given a triangle LAR such that:

$$LA = \frac{5^{248} - 3^2 \times 25^{123}}{4 \times 125^{82}}, \quad RA = (\sqrt{2} - 1)(\sqrt{2} + 1) - (2\sqrt{2} - 3)^2 - 8(\sqrt{2} - 2) \quad \text{and} \quad LR = \frac{4.5 \times 56 \times 1.2}{0.9 \times 4.2 \times 20}$$

(see figure below).

1) a) Show that $LR = LA = 4$. (2pts)

b) Write RA in the form $a\sqrt{2}$ where a is a natural integer to be determined. (1pt)

c) Deduce the nature of triangle LAR. (¾ pt)

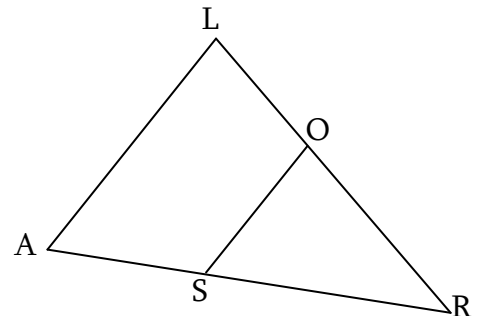
2) Let O be the point of $[LR]$ and S be the point of $[RA]$ such

$$\text{that } RO = \frac{2\sqrt{2} - 1}{\sqrt{2} + 1} \text{ and } RS = 5\sqrt{2} - 6.$$

a) Rationalize the denominator of RO . (¾ pt)

b) Show that the straight lines (SO) and (LA) are parallel. (1pt)

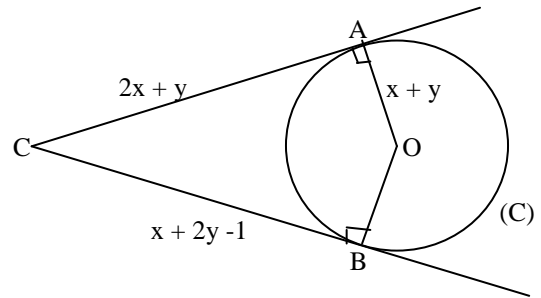
c) Calculate SO then write SO in scientific notation. (1pt)



3rd exercise: (4 ½ pts)

In the figure to the right:

- (C) is a circle of center O and radius $OA = OB = x + y$.
- [CA] and [CB] are two tangents to (C) at A and B such that $CA = 2x + y$ and $CB = x + 2y - 1$ (x and y are non zero natural integers)
- The perimeter of the quadrilateral CAOB is 14 cm.
- **Note: Don't draw the figure.**



1) State a relation between CA and CB. Justify. (1/2 pt)

2) Consider the system
$$\begin{cases} x - y = -1 \\ x + y = 3 \end{cases}$$

Show that the above system is a modeling or a translation of the given information. (1 1/2 pts)

3) a) Solve the system then deduce the lengths CA, CB, and AO. (1 1/2 pts)

b) Calculate CO. (1pt)

4th exercise: (3 1/2 pts)

In a rectangle the width y and the length x are proportional to the numbers 3 and 4 (x and y are non zero natural numbers in cm)

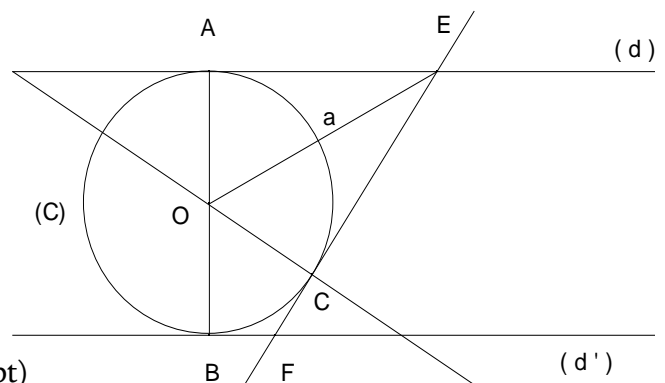
1) Show that y is a linear function of x. (1pt)

2) Represent in an orthonormal system the obtained linear function. (1pt)

3) Determine graphically and by calculation the length if the width is 6cm. (1 1/2 pts)

5th exercise: (9 1/2 pts)

Given two fixed parallel straight lines (d) and (d') such that the distance between them is equal to **a** (in cm). (C) is a variable circle of center O and tangent to (d) and (d') at A and B respectively. E is a point of (d) such that $OE = a$. The tangent to (C) through E cuts (C) at C and (d') at F. (See figure to the right and don't draw the figure).



1) a) Show that the points O, A and B are collinear. (3/4 pt)

b) Calculate the radius R of circle (C) in terms of **a**. (1/2 pt)

c) Can you say that the radius of (C) is proportional to **a**? Justify. (1/2 pt)

d) Determine the locus of O as A and B vary. (1pt)

2) a) Show that triangle AOE is semi-equilateral, then deduce AE without using pythagoras' theorem. (1 1/2 pts)

b) Determine how many tangents are issued through each point E and F to (C), then prove that triangle EOF is semi-equilateral. (1pt)

c) Show that $EF = \frac{2a\sqrt{3}}{3}$. (3/4 pt)

3) Let M be the midpoint of [EF]. Calculate OM. (1/2 pt)

4) a) Justify that the quadrilateral BF EA is a right trapezoid, then prove that (OM) and (AE) are parallel. (1pt)

b) Let H be the point of intersection of (AB) and (EF). Show that $\frac{AE}{HE} = \frac{OM}{HM}$ (1pt)

5) Calculate $\hat{B}OF$ and $\hat{A}HE$ then deduce that B is the midpoint of [OH]. (1pt)