BREVET BLANC N°1

JANUARY 2012

duration: 2h

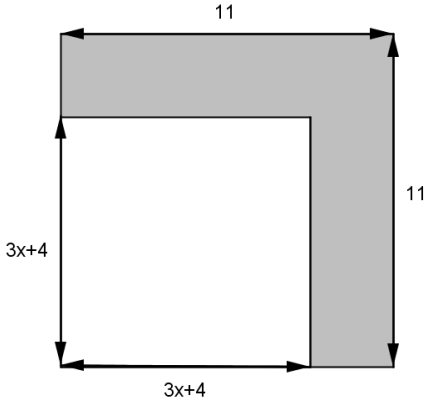
Presentation and explanations (4 points)

Ecole Internationale Manosque 3e

Numerical Activities

Exercise 1. ***(5 pts)***

Consider the figure opposite, which is made up of two squares.



1. a) Calculate the area A_1 of the white part.

   b) For which value of x is the value of A_1 zero ?

2. a) Calculate the area A_2 of the grey part and expand and simplify your answer.

   b) Expand the expression $(3x+15)(-3x+7)$ and thus deduce the factorised form of A_2.

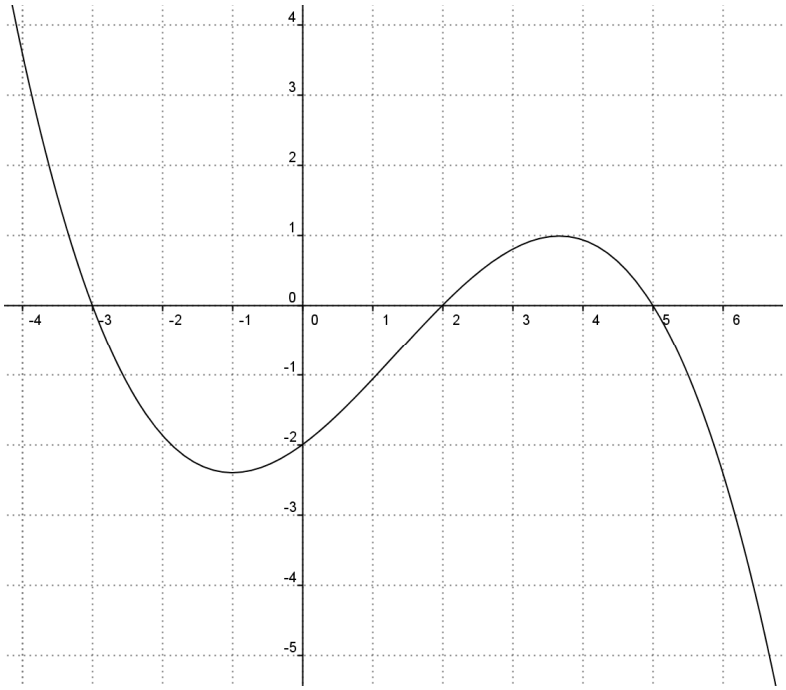
   c) Solve the equation $(3x+15)(-3x+7)=0$.

Exercise 2. ***(5 pts)***

Questions 1 and 2 are independent.

1. Consider the function f defined by $f : x \mapsto 2x^2 - 3$.
   a. Calculate the images of the numbers 1 and then -3 under f.
   b. Find the arguments of -3 under f.

2. Consider the function *g* whose graph is drawn below :



   a) Using the graph, find the images of 1 and -3.
   b) Using the graph, find the arguments of 0 and then of 1.

Exercise 3. ***(6 pts)***

This exercise is Multiple Choice. No justification is required.
For each of the questions, three answers are proposed, of which only one is right.
No points will be taken off if a wrong answer is given.

For each of the questions, circle the right answer.

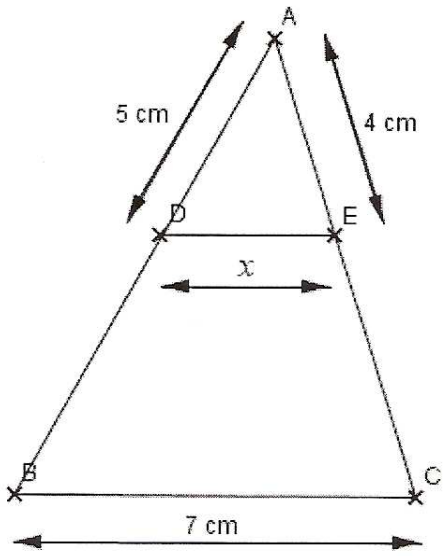
		Proposed answers		
1.	$\frac{5}{3}-\frac{2}{3}\times\frac{3}{4}=$	$1,16$	$\frac{7}{6}$	$\frac{3}{4}$
2.	The standard form of $12,5\times10^{-4}$ is	$1,25\times10^{-3}$	$0,00125$	$1,25\times10^{-5}$
3.	$\frac{10^2\times10^6}{\left(10^3\right)^3\times10^{-1}}=$	10	1	0
4.	$\frac{10}{1+\frac{2}{1+\frac{2}{1+1}}}=$	$\frac{10}{3}$	15	5
5.	The equation $2x=4x^2$	Has no solutions	Has 0 for solution	Has 0 and 0.5 for solutions
6.	The inequation $\frac{3x}{2}\leq-3$ has the numbers x for solutions where	$x\leq-2$	$x\geq-2$	$x\leq\frac{2}{3}$

GÉOMÉTRICAL ACTIVITIÉS *(10 pts)*

In the figure opposite, (DE) // (BC).

AD = 5 cm, AE = 4 cm and BC = 7 cm.

The distance DE is denoted *x*.



1ST PART :

In this part, we take $x = 5.6$ cm.

1- Calculate AC and prove that AB = 6.25 cm. Carefully justify your calculations and give the name of the properties you use.

2- Calculate the perimeter of the triangle ABC.

3- Draw the figure its actual size.

2ND PART :

In this part, we calculate as a function of x.

1- Explain why $AC = \frac{28}{x}$ and $AB = \frac{35}{x}$.
Carefully justify your calculations and give the name of the property you use.

2- From the above, deduce that the perimeter $p(x)$ of the triangle ABC in terms of x is $p(x) = \frac{63}{x} + 7$.

3- Copy and fill in the following table of values of the function p :

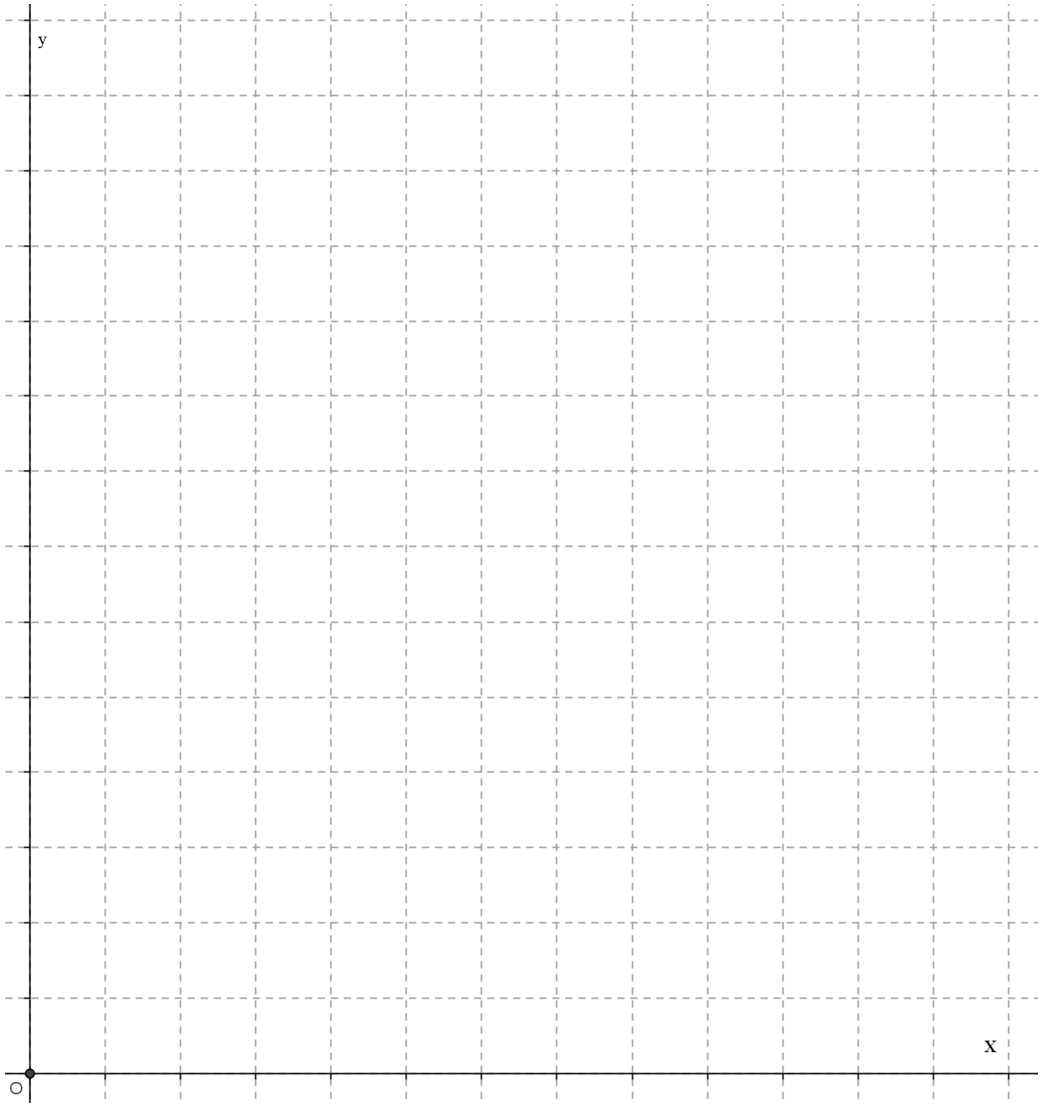
x	1	2	3	4	5	6
$p(x)$						

4- On the set of axes below, draw the graph of the function p for x between 1 and 6.

Use the following units :

1 cm for 0.5 units on the x-axis,

1 cm for 5 units on the y-axis.



5- From the graph, find the values of x (rounded to 1 decimal place) for which the perimeter of the triangle ABC is equal to :

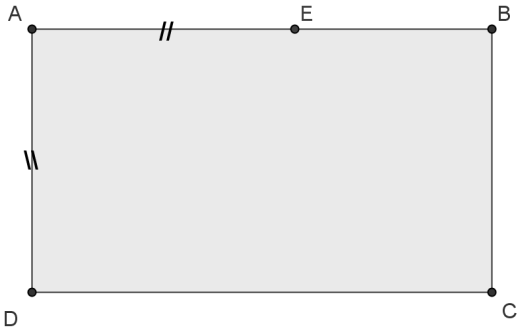
a- 50 cm,

b- 25 cm.

Write the answers carefully on your sheet and make the corresponding dotted lines appear on the graph.

Problems

Exercise 1. ***(2.5 pts)***



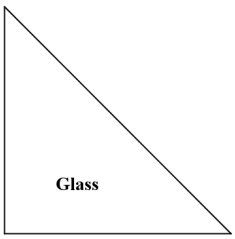
You are not asked to reproduce the figure.
The unit is 1 cm.

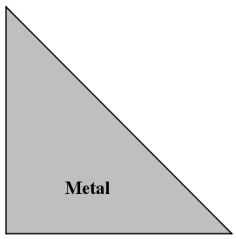
ABCD is a rectangle. Given AE = AD = 3 and EB = x,

1. Calculate the perimeter of ABCD as a function of x. (justify)
2. Solve the equation $2x+12=20$.
3. Find the value of x for which the perimeter of ABCD is 20.

Exercise 2. ***(3 pts)***

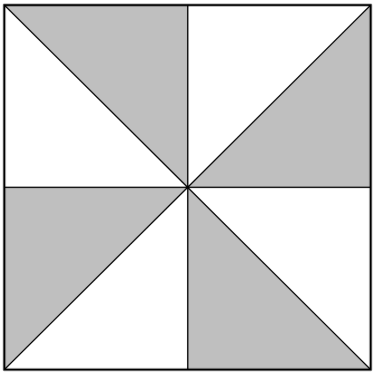
Pieces of jewellery are made from triangles which all have the same shape.
Some are made out of metal (represented in grey), others out of glass (represented in white).
Three examples of these pieces of jewellery are shown below.



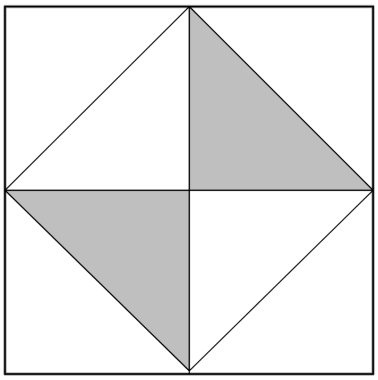


All the metal triangles cost the same price.
All the glass triangles cost the same price.

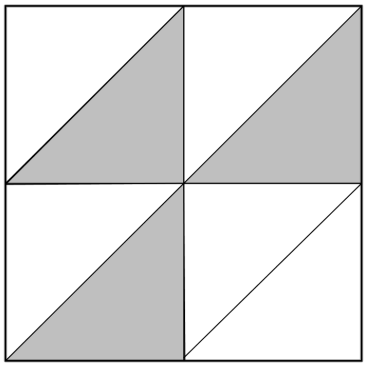
Piece of jewellery n°1 is worth 11€ ; Piece of jewellery n°2 is worth 9.10€.



Piece of jewellery n°1



Piece of jewellery n°2



Piece of jewellery n°3

What is the price of piece of jewellery n°3 ?

Even if your work is not finished, leave proof of your research: it will be taken into account in the mark.

Exercise 3. ***(2.5 pts)***

The human heart beats at about 5000 beats per hour.

1. Give the standard form of 5 000.
2. Calculate the number of heartbeats in a life that lasts 80 years (Consider that there are 365 days in a year)

   Give the result in standard form and show details of your calculations.

BREVET BLANC N°1
CORRECTION

Numerical Activities

Exercise 1. ***(5 pts)***

3. a) The area of the white part is $A_1=(3x+4)^2$.

   b) $A_1=(3x+4)^2=0$ if, and only if $3x+4=0$,so for $x=-\frac{4}{3}$

4. a) The area of the grey part is $A_2=11^2-A_1=121-(3x+4)^2$. So $A_2=121-(3x+4)(3x+4)=121-(9x^2+12x+12x+16)=121-9x^2-24x-16=-9x^2-24x+105$.

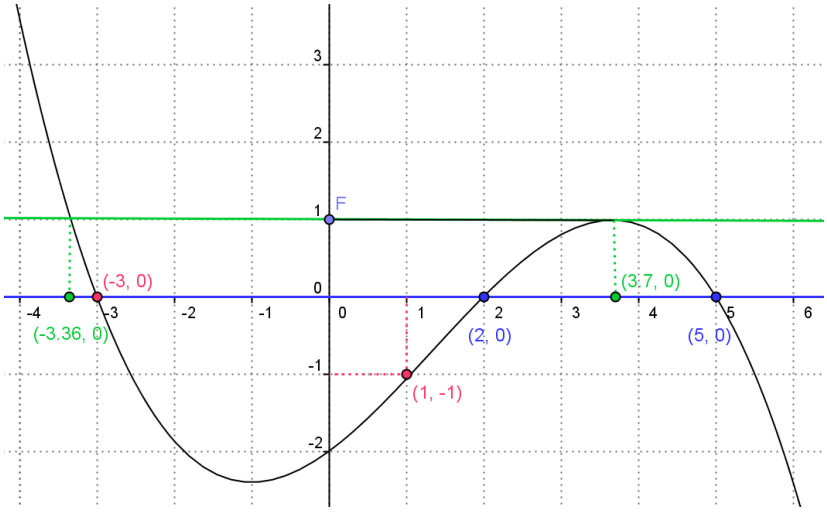
   b) $(3x+15)(-3x+7)=-9x^2-45x+21x+105=-9x^2-24x+105=A_2$. $(3x+15)(-3x+7)$ is thus the factorised form of A_2.

   c) The equation $(3x+15)(-3x+7)=0$ is a zero-product equation : $(3x+15)(-3x+7)=0$ only if $(3x+15)=0$ or $(-3x+7)=0$. The two only solutions are thus $x=\frac{-15}{3}=-5$ and $x=\frac{-7}{-3}=\frac{7}{3}$

Exercise 2. ***(5 pts)***

1. Consider the function f defined by $f:x\mapsto 2x^2-3$.
   a. The image of 1 is $f(1)=2\times1^2-3=-1$ and the image of -3 is $f(-3)=2\times(-3)^2-3=2\times9-3=15$.
   b. The arguments of -3 are the solutions of the equation $2x^2-3=-3$,which is equivalent to $2x^2=0$. So 0 is the only argument of -3 under f.

2.
   a) The image of 1 is -1. The image of -3 is 0. (in red)
   b) Graphically, the arguments of 0 are -3, 2 and 5 (in blue)
   Those of 1 are -3.4 and 3.7 (in green)



Exercise 3. ***(6 pts)***

$\frac{5}{3}-\frac{\cancel{2}}{\cancel{3}}\times\frac{\cancel{3}}{\cancel{4}2}=\frac{5}{3}-\frac{1}{2}=\frac{10-3}{6}=\frac{7}{6}$

The standard form of $12,5\times10^{-4}$ is $1,25\times10^{-3}$

$\frac{10^2\times10^6}{(10^3)^3\times10^{-1}}=\frac{10^8}{10^{9-1}}=\frac{10^8}{10^8}=1$

$\frac{10}{1+\frac{2}{1+\frac{2}{1+1}}}=\frac{10}{1+\frac{2}{1+1}}=\frac{10}{1+1}=5$

The equation $2x=4x^2$ is equivalent to $2x-4x^2=0$ or $2x(1-2x)=0$ which has two solutions (null-product) : 0 and 0.5

The inequation $\frac{3x}{2}\le-3$ is equivalent to $x\le-\cancel{3}\times\frac{2}{\cancel{3}}=-2$ (multiplying both sides by 2/3)

GEOMETRICAL ACTIVITIES *(10 pts)*

1ST PART : In this part, we take $x = 5.6$ cm.

1- Since (DE) // (BC), ADE and ABC form a Thales configuration and thus , according to Thales' theorem $\frac{AD}{AB}=\frac{AE}{AC}=\frac{DE}{BC}$. So $\frac{5}{AB}=\frac{4}{AC}=\frac{5.6}{7}$. We thus have $AC=\frac{4\times 7}{5.6}=5$. Now $AB=\frac{5\times 5}{4}=6.5$.

2- The perimeter of the triangle ABC is $AC+CB+BA=5+7+6.5=18.5$ cm.

2ND PART : In this part, we calculate in terms of x.

1- Since (DE) // (BC), ADE and ABC form a Thales configuration and thus , according to Thales' theorem $\frac{AD}{AB}=\frac{AE}{AC}=\frac{DE}{BC}$. So $\frac{5}{AB}=\frac{4}{AC}=\frac{x}{7}$. We thus have $AC=\frac{4\times 7}{x}=\frac{28}{x}$.

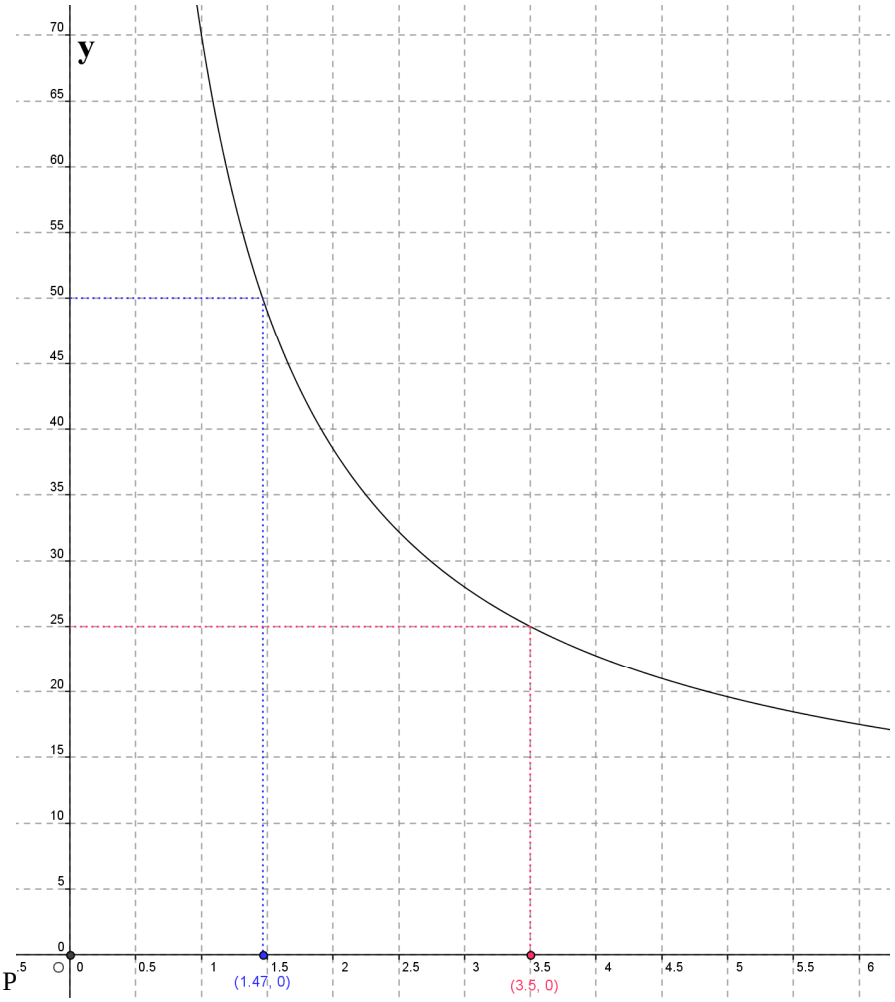
Now $AB=\frac{5\times\frac{28}{x}}{4}=5\times\frac{7\cancel{28}}{x}\times\frac{1}{\cancel{4}}=\frac{35}{x}$.

2- The perimeter $p(x)$ of the triangle ABC in terms of x is $p(x)=AC+CB+BA=\frac{28}{x}+7+\frac{35}{x}=\frac{63}{x}+7$.

3-

x	1	2	3	4	5	6
$p(x)$	70	38.5	28	22.8	19.6	17.5

4-



5- Graphically the values of x for which the perimeter of the triangle ABC is equal to 50 cm is 1.5 cm

Graphically the values of x for which the perimeter of the triangle ABC is equal to 25 cm is 3.5 cm

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Problems

Exercise 1. ***(2.5 pts)***

ABCD is a rectangle. We have : AE = AD = 3 and EB = x.

1. The perimeter of ABCD with respect to x is $2\times(AE+EB)+2\times AD=2\times(3+x)+6=2x+12$
2. $2x+12=20 \Leftrightarrow 2x=8 \Leftrightarrow x=4$.
3. The value of x for which the perimeter of ABCD is 20 is 4 (from the two previous questions).

Exercise 2. ***(3 pts)***

To make 2 pieces of jewellery n°3, you need 6 metal triangles and 10 glass ones, exactly the same as to make piece n°1 and piece n°2. The price of 2 pieces of jewellery n°3 is thus 9.1+11=20.1€

The price of piece of jewellery n°3 is thus 10.05€.

Exercise 3. ***(2.5 pts)***

The human heart beats about 5000 times per hour.

1. The standard form of 5 000 is 5×10^3 .
2. The number of heart beats in a life of 80 years is $5\times10^3\times24\times365\times80=3.504\times10^9$