

## MATHEMATICS

### EXERCISE 1

**6mks**

The table indicates for the same distance the variations  $y_i$  of fuel consumption of certain mark of vehicles and their power  $x_i$ . ( $x_i$  is measured in horse power and  $y_i$  in liters)

$x_i$	3	4	5	6	7	8	9	10
$y_i$	10	12	20	23	26	30	32	35

1) a) In an orthogonal reference frame, draw the scatter diagram associated to these data.

.1cm on the x-axis (abscissa) represents 1 horse power

.1cm on the y-axis (ordinate) represents 5litres.

**1mk**

2) Determined the coordinate of the mean point G of the cloud of points and plot it.

**1mk**

3) a) Calculate the variances  $V(x)$  and  $V(y)$ , la covariance  $Cov(x;y)$  then deduce the coefficient of the linear correlation of the data.

**1.5mk**

b) Can we make and adjustments for this data?

**0.5mk**

4) By the least square method, determine an equation of a linear regression y on x.

**1mk**

5) a) Give an estimate of the quantity of the fuel consumed for a vehicle of 12 horse power.

**0.5mk**

b) Give an estimate of the power of a vehicle that consumes 50 liters of fuel for this distance.

**0.5mk**

### EXERCISE 2

**4mks**

The incomplete table below shows the number of part time and permanent teachers of a certain private institution where there are 100 teachers.

	Men	Women	Total
Part time		20	
Permanent			40
Total		28	100

1) Reproduce and complete the table

**1.5mk**

2) A teacher is chosen at random from that list of teachers; calculate the probability of the following events:

$E_1$  "The chosen teacher is part time given that he is a man"

**0.5mk**

$E_2$  "The chosen teacher is permanent given that he is a man"

**0.5mk**

3) the head of the institution (not counted in the list of teachers) desire to constitute a commission of the three teachers to take care of relation with the neighboring institution, for this, he chooses simultaneously three teachers in the list. Let X be the random variable the number of woman in the commission

a) Determine the probability law of X

**1mk**

b) Calculate the expectation  $E(x)$  of this random variable.

**0.5mk**

### EXERCISE 3

**5mks**

1) Given that  $P(z) = z^3 + 4(1 - i)z^2 - 2(2 + 7i)z - 16 + 8i$

a) Show that there exist a real number  $r$  such that  $P(r) = 0$ .

**0.75mk**

b) Deduce the values of  $a$  and  $b$  such that  $P(z) = (z - r)(z^2 + az + b)$

**0.75mk**

c) Solve in  $\mathbb{C}$  the equation  $P(z) = 0$ .

**0.75mk**

2) Given  $u = \sqrt{3} + i$ .

a) Determine the modulus and argument of  $u$ .

**0.75mk**

b) Give the exact values of  $u^3$  and  $u^6$

**1mk**

c) Determine the value of the natural number  $n$  for which:

$-u^n$  is a real number

**0.5mk**

$-u^n$  is an imaginary number.

**0.5mk**

### EXERCISE 4

**6mks**

I- let  $g$  be a numerical function defined by  $g(x) = (x + 2)^2 - 1 + \ln(x + 2)$

1) Determine the domain of  $g$

**0.5mk**

2) Calculate  $g'(x)$  and deduce the sense of variations.

**0.5mk**

3) Calculate  $g(-1)$  and deduce the sign  $g(x)$

**0.5mk**

II- we consider the function  $f$  defined by  $f(x) = x - \frac{\ln(x+2)}{x+2}$ .

1) a) The function  $f$  and  $g$  have the same domain of definition? Justify your answer.

**0.5mk**

b) Calculate the limit of  $f$  at the boundaries of the domain.

**0.5mk**

c) Show that  $f'(x) = \frac{g(x)}{(x+2)^2}$

**0.5mk**

2) let  $C$  be the curve representing  $f$  and  $D$  the straight line  $y = x$

a) Show that  $C$  has a vertical asymptote and the line  $D$  is an oblique asymptote

**1mk**

b) Sketch with care the  $C$  and the asymptote (unit of axis 2cm).

**1mk**

3) let  $\alpha \geq -1$ , calculate the area  $A(\alpha)$  of the portion of the curve  $C$ , the  $x$ -axis and the straight line,  $D$  and the equations  $x = -1$  and  $x = \alpha$  what is the limit of  $A(\alpha)$  as the  $\alpha$  tends to  $+\infty$