COMMON ENTRANCE EXAMINATION JULY 2010

SECOND CYCLE TECHNICAL EDUCATION 3HOURS

# PAPER: APPLIED MATHEMATICS (MINOR) FOR ALL ENGINEERING

## EXERCISE 1: 7 Pts

Let a function $ax^2+bx+c$ periodic function of period $2\pi$ so that $f(0)=f(2\pi)=\pi$ and $f(\pi)=0$

1. Determine a, b, and c then express f(x)
2. Draw the curve of $f$ on the interval $[-4\pi;4\pi]$
3. Calculate the average value of $f$ on one period
   a) determine $S(f)_{(x)}$ the fourier sum of $f$
   b) explain why this sum converges and write the corresponding equality
4. show that the general sum of term $\frac{(-1)^n}{n^2}$ converges
   a) determine its sum with the help of the question 3b

## EXERCISE 2:7Pts

Let f the endomorphism of vectorial space E basic B= (I,j,k) defined by f(i)=j+2k; f(j)=2j+4k and f(k)=4i+j-2k

5. Determine the characteristics polynomial of f
6. Show that the endomorphism f can be diagonalized and do it
7. Give the passage matrix p from basic B to the basic $B_0$ of eigenvectorwhat formula show the relationship between matrix A of f according to basic $B_0$ ?
8. Compute the reverse matrix $P^{-1}$

9. Compute the matrix $D^5$ 

10. Solve the systemsdifferentialequations

$$\begin{cases} \frac{dy}{dt} = 4z \\ \frac{dy}{dt} = x + 2y + z \\ \frac{dz}{dt} = 2x + 4y - 2z \end{cases}$$



***EXERCISE: 3***6Pts

One considers the following picture giving the seilling price of y (in $10^5$ francs) of a second-hand vehicle according to its x age (in years)

| Age | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
|---|---|---|---|---|---|---|---|---|---|
| price | 2.50 | 1.70 | 1.20 | 1.10 | 0.90 | 0.80 | 0.78 | 0.40 | |

One pose U=log(x) ( log means common logarithm ) the calculation will be done from the values approximate to $10^4$ close to the common logarithms

4. Calculates the linear interrelationship coefficient between U and Y
5. Determine an equation of the regression right of Y in U ( the sense of the root mean square )
6. Give an evaluation of the car price of 10 years age