EXAM OF CALCULUS

Pharmacy/Biotechnology 1st year — Version A — **June 15, 2018**

Duration: 1 hour.

(4 pts.) 1. Given the function $f(x,y) = A - (x^2 + Bx + y^2 + Cy)$:

(a) Find the values of A, B y C that give f a local maximum value of 15 at the point $(-2,1)$.

(b) For that values, compute the equation of the tangent plane and the normal line to f at the point $(-2,1)$.

Solution

(3 pts.) 2. The population of a microorganism increases in such a way that after one hour from the begining of the culture, the population has doubled.

(a) How long will it take to the initial population to be multiplied by 10?

(b) How many times will the population have been multiplied by after 5 hours from the begining of the culture?

Solution

(3 pts.) 3. A type of bacteria requires constant PH in order to reproduce. It is known that the PH of a medium depends on three substances x, y and z according to the function

$$ph(x,y,z) = 14e^{-(xy+y\sqrt{z})}.$$

If the concentration of the substances are $x = 1/2$, $y = 1$ and $z = 1/4$:

(a) What is the direction where the variation of the PH is maximum at that point? Is there any direction where the PH does not vary? How much will change the PH if the concentration of y increases at a rate double of the concentration of x and the concentration of z decreases at the same rate than the concentration of x?

(b) If we pretend the reproduction of the bacteria, how and how much must the concentration of z change if the concentration of y changes at a rate double of the concentration of x?

(c) Compute the polynomial of degree 1 that best approximate the PH for the concentrations of x, y and z given.

Solution
