EXAM OF CALCULUS

Pharmacy/Biotechnology 1st year   Version B   **February 4, 2022**

Duration: 1 hour.

(3.5 pts.) 1. The temperature of a gel depends on time according to the function $T(x) = x^2 + \ln(1.5 - x)$, where T is the temperature in degrees Celsius and x is the time in hours.

   (a) Compute the minimum and maximum temperature of the gel in the interval from 0 to 1.5 hours?

   (b) How fast is the temperature changing at 1.2 hours? Compute approximately the value of the temperature 5 minutes after using the tangent line.

   (c) At what time is the rate of change of temperature maximum?

   Solution

(3 pts.) 2. A dialysis machine works under the principle of Fick's Law, which states that the amount of waste material that passes through a membrane is proportional to the difference between the concentration of one side and the other of it. At the start of dialysis, the waste material concentration of a patient is 160 mg/dl and after 1 hour it drops to half, while the dialysate solution at the other side of the membrane remains at a constant concentration of 10 mg/dl. If dialysis finish when the patient reaches a concentration of 20 mg/dl, how long will the patient have to be on dialysis to get it?

   Solution

(3.5 pts.) 3. In a pharmacy, the amount of paracetamol Q demanded by customers depends on the price of paracetamol p and the price of ibuprofen b, according to the function

$$Q(p, b) = \frac{6b}{(p-1)p}$$

   (a) For which values of p and b this function make sense in this context?

   (b) If the price of paracetamol increases, will the demand for paracetamol increase or decrease?

   (c) If the prices of paracetamol and ibuprofen are $p = 2$ and $b = 1$ €, how should the prices of paracetamol and ibuprofen vary so that the quantity demanded of paracetamol increases as much as possible?

   (d) Assuming the same prices as in the previous question, how much will the quantity of paracetamol demanded change if the price of paracetamol increases half of ibuprofen price increase?

   Solution