1. The area (cm$^2$) of bacterial culture in a petri dish is given by the equation $P(t) = 10 - \frac{1}{2t+1}$ where $t$ is measured in hours after introduction of the bacteria.

   a) Sketch a graph of the population over time (you may use your calculator).

   b) Find any horizontal asymptotes of the function $P(t)$ and explain what they mean in terms of the bacteria population.

   c) The function also has a vertical asymptote. Find the vertical asymptote and explain why it does not have any meaning for the bacteria.
2. An entomologist wants to enclose a rectangular area for study. She has 120 feet of fence to use. What is the maximum area she can enclose?

![Diagram of a rectangle with dimensions x and y]

a) Find an equation relating $x$ and $y$.

b) Find an equation that gives the area of the enclosed region as a function of $x$.

c) Find the maximum possible value for the area (using either the first or second derivative test).

3. A dog is playing fetch on a beach. The dog’s goal is to get to his Frisbee as quickly as possible. The dog is 3 meters from the shore and his Frisbee is in the water 7 meters down the beach and 4 meters out (see the figure below). The dog moves at 2 m/s on land and 1 m/s in the water. Where should the dog enter the water in order to minimize the time it takes to get to the Frisbee?

![Diagram of a dog's path from land to water and then to the Frisbee]