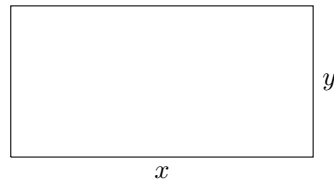


1. The area ( $\text{cm}^2$ ) of bacterial culture in a petri dish is given by the equation  $P(t) = 10 - \frac{1}{2t+1}$  where  $t$  is measured in hours after introduction of the bacteria.
- Sketch a graph of the population over time (you may use your calculator).
  - Find any horizontal asymptotes of the function  $P(t)$  and explain what they mean in terms of the bacteria population.
  - 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 want to enclose a rectangular area for study. She has 120 feet of fence to use. What is the maximum area she can enclose?



- Find an equation relating  $x$  and  $y$ .
- Find an equation that gives the area of the enclosed region as a function of  $x$ .
- 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?

