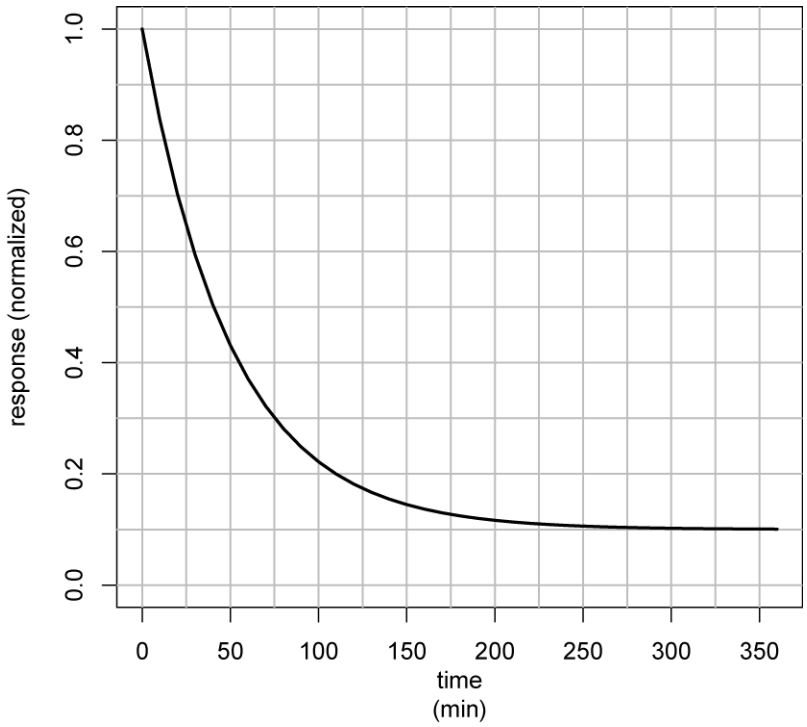
Question 1

Discuss the differences between a system of difference equations and a system of differential equations. Give an example of a biological system that would most appropriately be modeled using difference equations and explain why a differential equation representation would not be appropriate.

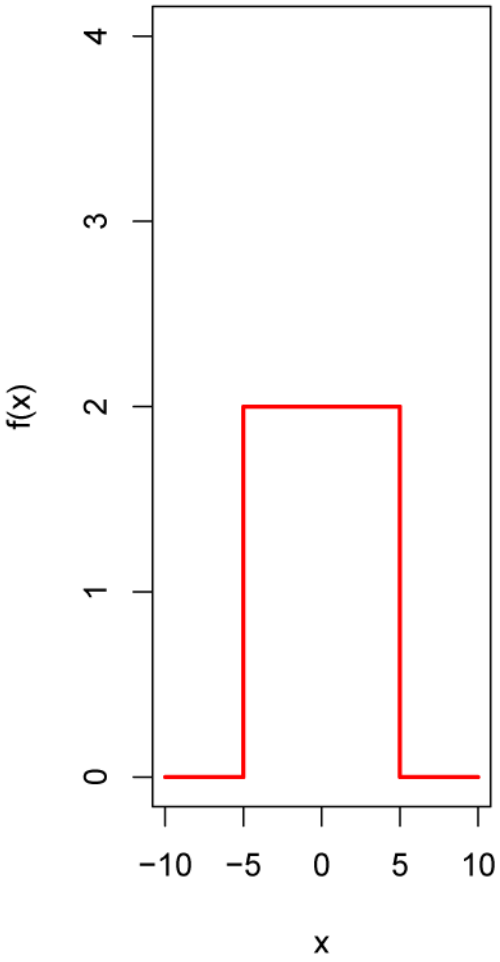
Question 2

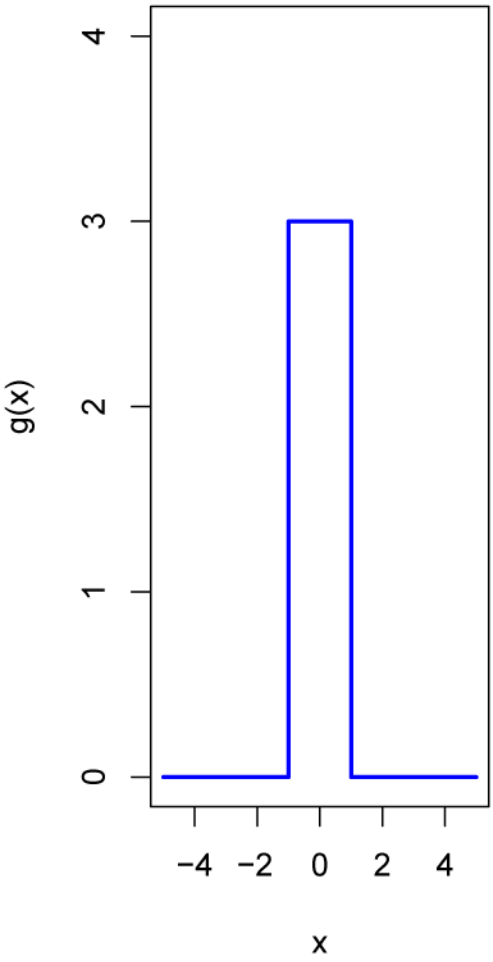
Consider the time-dependent response shown in the figure below. Estimate the time constant for the response, and explain your reasoning.

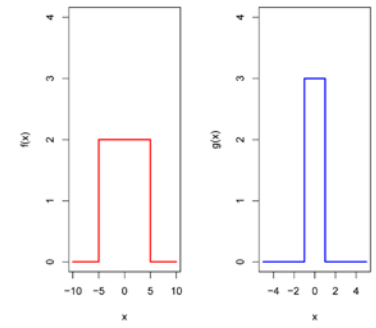


Question 3

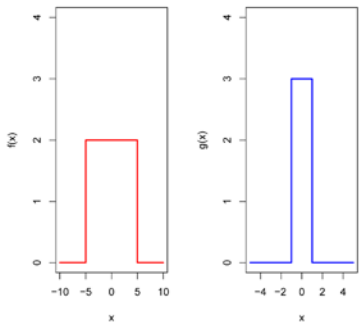
Consider the two functions $f(x)$ and $g(x)$ shown in the sketches below. Sketch the convolution of the two functions: $f(x) \otimes g(x)$.





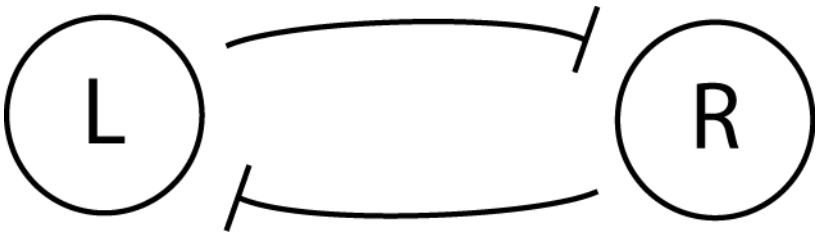

f(x)
0
1
2
3
4
−10
−5
0
5
10
x
g(x)
0
1
2
3
4
−4
−2
0
2
4
x

(another page if you need it)



Question 4

In the context of the diagram below, explain the principle of common mode rejection. Indicate where such a design might be used in a biological system, and what desirable properties it might have.



Question 5

Explain the phenomenon of aliasing, and what implications it has for determining sampling rate in experimental designs.