

## Question 1

a)

There is a type of bimolecular chemical reaction known as the "Brusselator" which is governed by the following ordinary differential equations:

$$\frac{\partial}{\partial t}X(t) = A + X(t)^2Y(t) - BX(t) - X(t) \quad (1)$$

$$\frac{\partial}{\partial t}Y(t) = BX(t) - X(t)^2Y(t) \quad (2)$$

Experimental data measuring the values of X and Y over time is shown in Table 1. Using these data points and least squares regression, find the values of A and B from equations 1 and 2 which fit the data the best.

b)

Plot the solution to the differential equations with error bars calculated by Gaussian error propagation from the values of the parameters and their standard errors.

## Question 2

Assuming that A = 2 and B = 5 and that X[0] = Y[0] = 1 find the average value of X and Y from time t=0 to t=30

Table 1: Brusselator data

t	X	Y
0	0.82	0.85
1	0.53	1.78
2	0.52	2.32
3	0.59	2.62
4	0.66	2.58
5	1.42	2.16
6	1.56	1.26
7	0.92	1.39
8	0.81	1.91
9	0.8	2.34
10	0.75	2.5
11	1	2.13
12	1.35	1.65
13	1.03	1.54
14	0.87	1.83
15	0.84	2.18
16	0.71	2.34
17	1.04	2.29
18	1.27	1.85
19	1.09	1.68
20	0.96	1.86
21	0.88	2.09
22	0.72	2.21
23	0.81	2.23
24	1.11	2.09
25	1.17	1.73
26	1.22	1.81
27	1.01	2.17
28	0.79	2.22
29	0.78	2.27
30	1.19	2.01