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Lab Assignment 2

We found the safe range of initial WBCs for patients to be 5650.379 to 8512.952, inclusive [Figure 5]. Taking the representative data set from the 10 patients, we started by finding the coefficients of the quartic polynomial for each individual patient over the first month of taking the drug. This was accomplished through using Gaussian elimination on each patient's weekly data with [Figure 6]. In order to find a general quartic polynomial of the drug's effect on WBC over the first month, we averaged the coefficients of the 10 individual patient polynomials to find coefficients of a general equation. From that general function, we then manipulated the y-intercept, or initial WBC values in order for the local minimum and maximums of the function within one month (t=4) to not exceed 10,000 or fall below 5,000 [Figure 4-6].

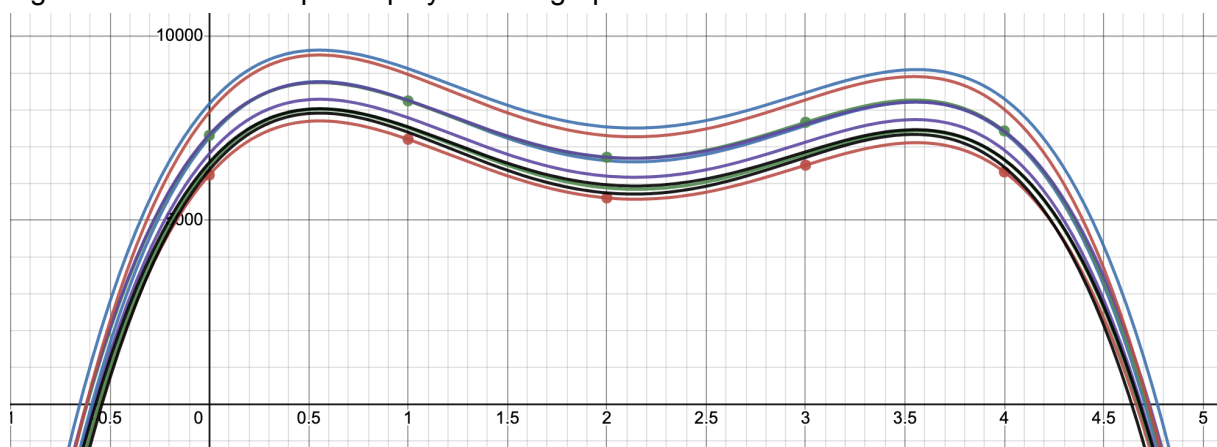Figure 1: All Patients' quartic polynomials graphed.

Figure 2: Equation that results from taking the average of all Patients' quartic polynomials' coefficients that affect variables of the same power.
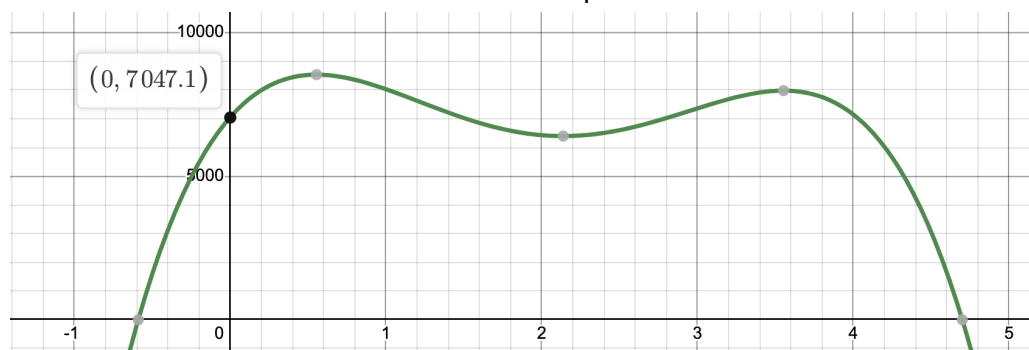

Figure 3: Average Quartic Polynomial vertically shifted up by 1465.952 so that the Ymax = 10000.
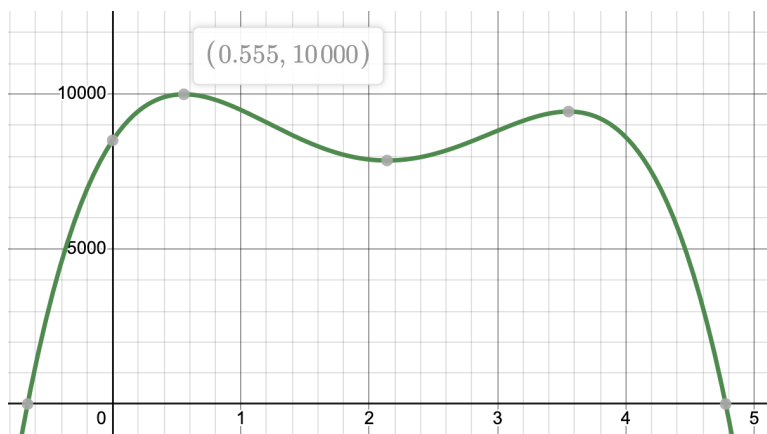
(0.555, 10000)

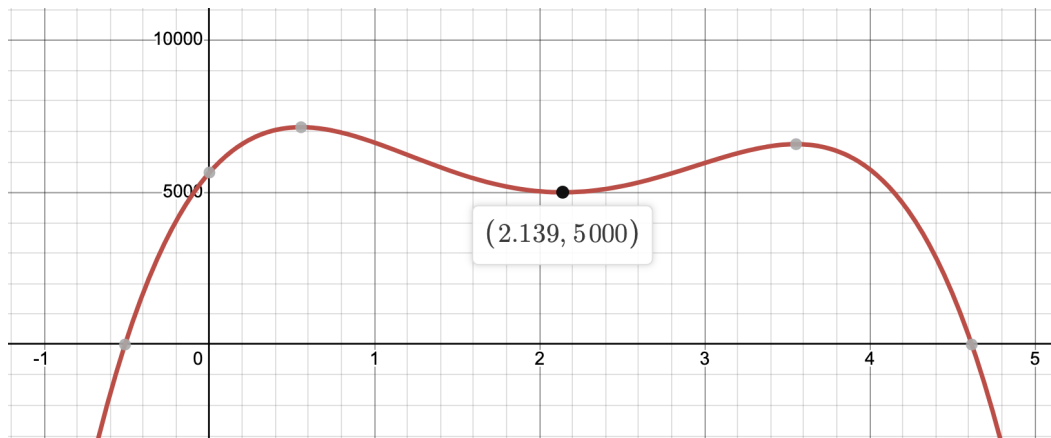Figure 4: Average Quartic Polynomial vertically shifted down by 1396.621 so that Ymin = 5000.

(2.139, 5000)

Figure 5: Polynomials from Figure 3 and Figure 4, y intercepts represent the safe range of initial values
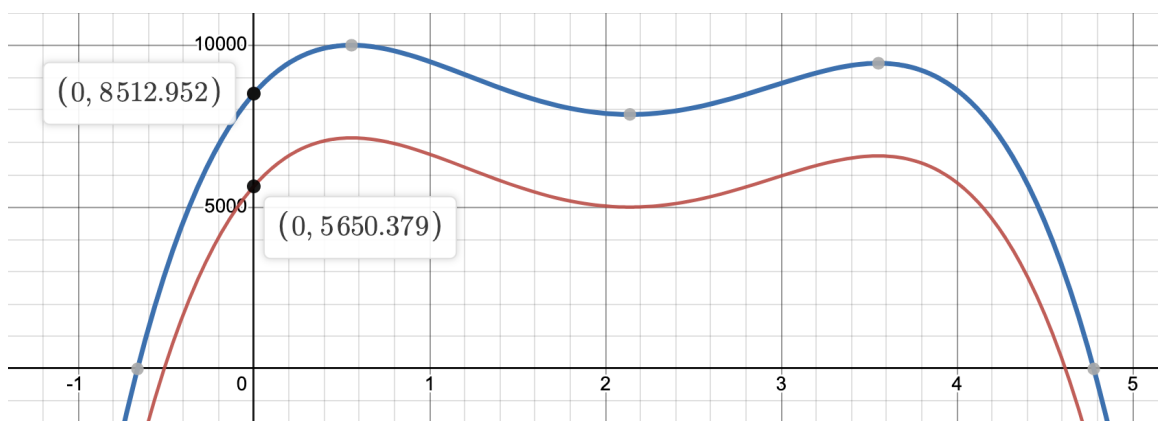

(0, 8512.952)

(0, 5650.379)

Figure 6: Coefficients of individual patient and general quartic polynomial functions.

```
The coefficients for patient MIVQ:
 [ -358.875      2995.08333333 -7755.625      6089.41666667
   6233.        ]

The coefficients for patient KKOZ:
 [ -367.5        3070.66666667 -7961.5        6269.33333333
   6500.        ]
The coefficients for patient MLPL:
 [ -363.875   3029.75   -7825.625   6138.75    6810.    ]

The coefficients for patient IOJH:
 [ -380.54166667   3164.25        -8164.45833333   6402.75
   6371.        ]

The coefficients for patient EQQX:
 [ -373.83333333   3116.        -8055.66666667   6326.5
   7244.        ]

The coefficients for patient FIDQ:
 [ -359.54166667   2983.25        -7668.45833333   5982.75
   7307.        ]
```

```
The coefficients for patient SHGV:
 [ -353.16666667   2940.83333333 -7591.83333333   5939.16666667
   7328.        ]

The coefficients for patient JDLJ:
 [ -357.875      2982.58333333 -7713.125      6055.41666667
   6571.        ]

The coefficients for patient PKPL:
 [ -383.    3185.5 -8220.    6442.5  7941. ]

The coefficients for patient OUZX:
 [ -361.25   3010.    -7771.25   6078.5    8166.  ]

The average coefficients are:
 [ -365.94583333   3047.79166667 -7872.75416667   6172.50833333
   7047.1       ]

In [2]:
```

Code:

```python
 8    import numpy as np
 9    coefficient = np.array([[0,0,0,0,1],[1,1,1,1,1],[16,8,4,2,1],[81,27,9,3,1],[256,64,16,4,1]])
10    #t values for week 2
11    matrixT2 = np.array([16,8,4,2,1])
12    #t values for week 3
13    matrixT3 = np.array([81,27,9,3,1])
14    #t values for week 4
15    matrixT4 = np.array([256,64,16,4,1])
16
17    #PATIENT MIQV
18    #constants of patient MIQV
19    constant1 = np.array([6233,7203,5608,6499,6314])
20    matrixConstants1 = np.linalg.solve(coefficient,constant1)
21    print("The coefficients for patient MIVQ:\n", matrixConstants1)
22    print()
```

```python
36    #PATIENT KKOZ
37    #constants of patient KKOZ
38    constant2 = np.array([6500,7511,5878,6795,6636])
39    matrixConstants2 = np.linalg.solve(coefficient,constant2)
40    print("The coefficients for patient KKOZ:\n",matrixConstants2)
41
42    #verify constants work for patient KKOZ week 2
43    #print("Pateint KKOZ week 2:", matrixConstants2.dot(matrixT2))
44    #print()
45
46    #PATIENT MLPL
47    constant3 = np.array([6810,7789,6201,7125,6907])
48    matrixConstants3 = np.linalg.solve(coefficient,constant3)
49    print("The coefficients for patient MLPL:\n",matrixConstants3)
50    print()
51
52    #PATIENT IOJH
53    constant4 = np.array([6371,7393,5744,6710,6444])
54    matrixConstants4 = np.linalg.solve(coefficient,constant4)
55    print("The coefficients for patient IOJH:\n",matrixConstants4)
56    print()
57
58    #PATIENT EQQX
59    constant5 = np.array([7244,8257,6621,7574,7382])
60    matrixConstants5 = np.linalg.solve(coefficient,constant5)
61    print("The coefficients for patient EQQX:\n",matrixConstants5)
62    print()
63
```

```python
#PATIENT FIDQ
constant6 = np.array([7307,8245,6712,7664,7428])
matrixConstants6 = np.linalg.solve(coefficient,constant6)
print("The coefficients for patient FIDQ:\n",matrixConstants6)
print()

#PATIENT SHGV
constant7 = np.array([7328,8263,6715,7615,7418])
matrixConstants7 = np.linalg.solve(coefficient,constant7)
print("The coefficients for patient SHGV:\n",matrixConstants7)
print()

#PATIENT JDLJ
constant8 = np.array([6571,7538,5964,6861,6652])
matrixConstants8 = np.linalg.solve(coefficient,constant8)
print("The coefficients for patient JDLJ:\n",matrixConstants8)
print()

#PATIENT PKPL
constant9 = np.array([7941,8966,7302,8274,8015])
matrixConstants9= np.linalg.solve(coefficient,constant9)
print("The coefficients for patient PKPL:\n",matrixConstants9)
print()

#PATIENT OUZX
constant10 = np.array([8166,9122,7538,8469,8300])
matrixConstants10 = np.linalg.solve(coefficient,constant10)
print("The coefficients for patient OUZX:\n",matrixConstants10)
print()


matrixAverageConstants = 1/10 *(matrixConstants1 + matrixConstants2 + matrixConstants3
                               + matrixConstants4 + matrixConstants5 + matrixConstants6
                               + matrixConstants7 + matrixConstants8 + matrixConstants9
                               + matrixConstants10)
print("The average coefficients are:\n", matrixAverageConstants)
```