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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.

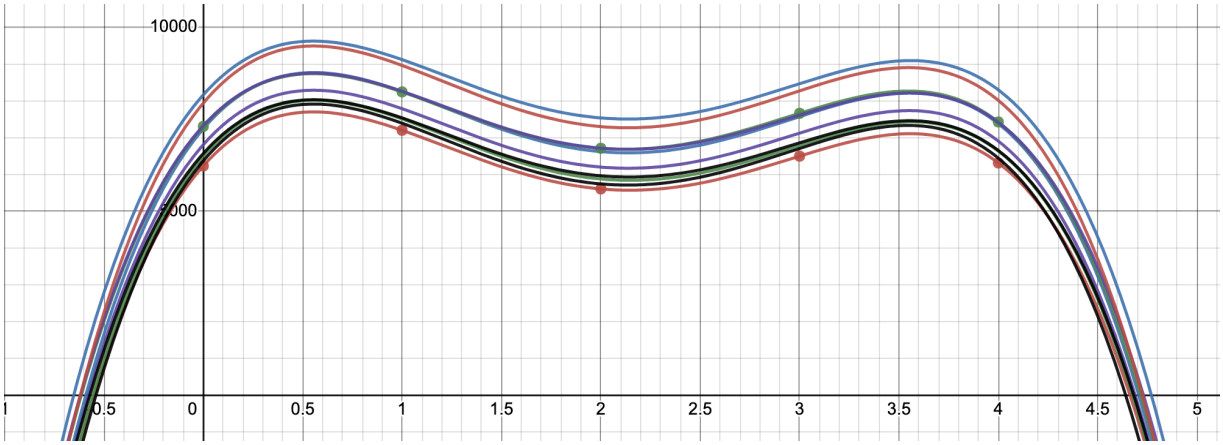

Figure 2: Equation that results from taking the average of all Patients' quartic polynomials' coefficients that affect variables of the same power.

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

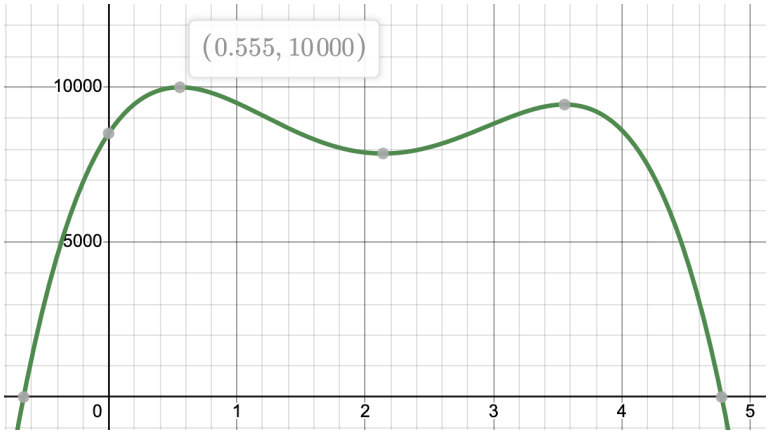

Figure 4: Average Quartic Polynomial vertically shifted down by 1396.621 so that Ymin = 5000.

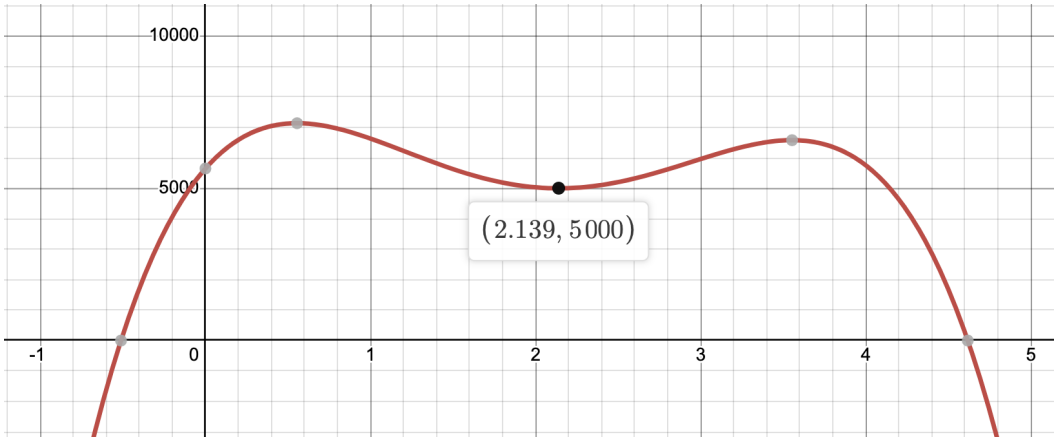

Figure 5: Polynomials from Figure 3 and Figure 4, y intercepts represent the safe range of initial values

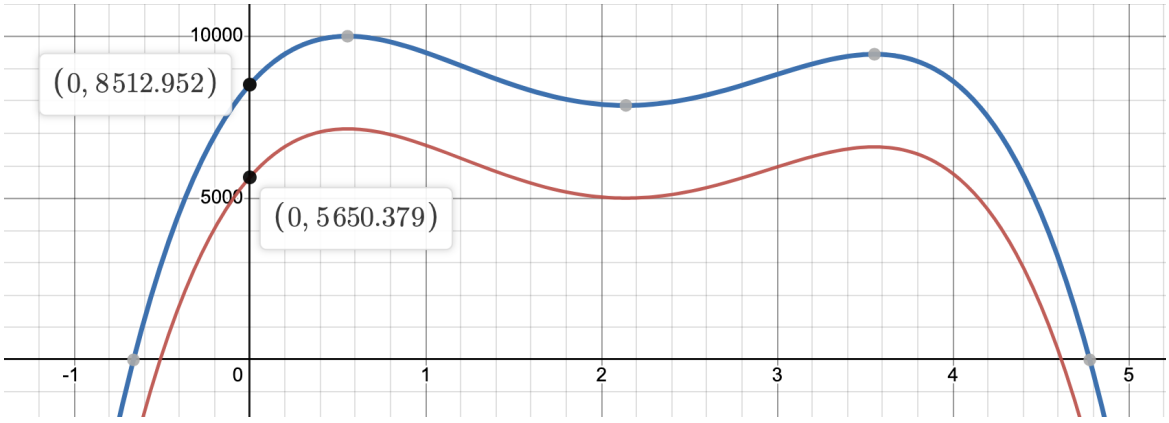

Figure 6: Coefficients of individual patient and general quartic polynomial functions.

```
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:

```
import numpy as np
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]])
#t values for week 2
matrixT2 = np.array([16,8,4,2,1])
#t values for week 3
matrixT3 = np.array([81,27,9,3,1])
#t values for week 4
matrixT4 = np.array([256,64,16,4,1])

#PATIENT MIQV
#constants of patient MIQV
constant1 = np.array([6233,7203,5608,6499,6314])
matrixConstants1 = np.linalg.solve(coefficient,constant1)
print("The coefficients for patient MIVQ:\n", matrixConstants1)
print()
```

```
#PATIENT KKOZ
#constants of patient KKOZ
constant2 = np.array([6500,7511,5878,6795,6636])
matrixConstants2 = np.linalg.solve(coefficient,constant2)
print("The coefficients for patient KKOZ:\n",matrixConstants2)

#verify constants work for patient KKOZ week 2
#print("Pateint KKOZ week 2:", matrixConstants2.dot(matrixT2))
#print()

#PATIENT MLPL
constant3 = np.array([6810,7789,6201,7125,6907])
matrixConstants3 = np.linalg.solve(coefficient,constant3)
print("The coefficients for patient MLPL:\n",matrixConstants3)
print()

#PATIENT IOJH
constant4 = np.array([6371,7393,5744,6710,6444])
matrixConstants4 = np.linalg.solve(coefficient,constant4)
print("The coefficients for patient IOJH:\n",matrixConstants4)
print()

#PATIENT EQQX
constant5 = np.array([7244,8257,6621,7574,7382])
matrixConstants5 = np.linalg.solve(coefficient,constant5)
print("The coefficients for patient EQQX:\n",matrixConstants5)
print()
```

```
#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)
```