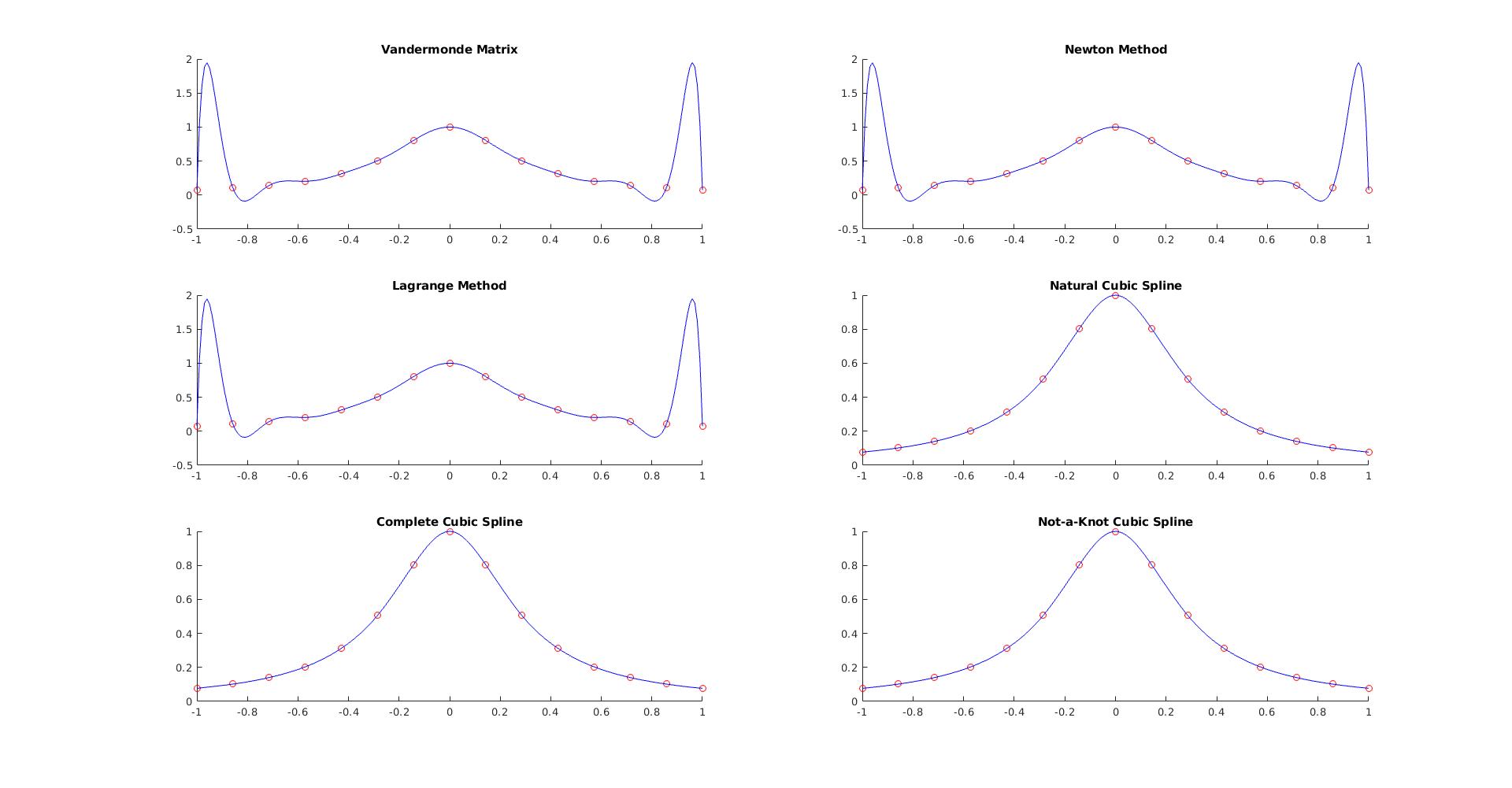
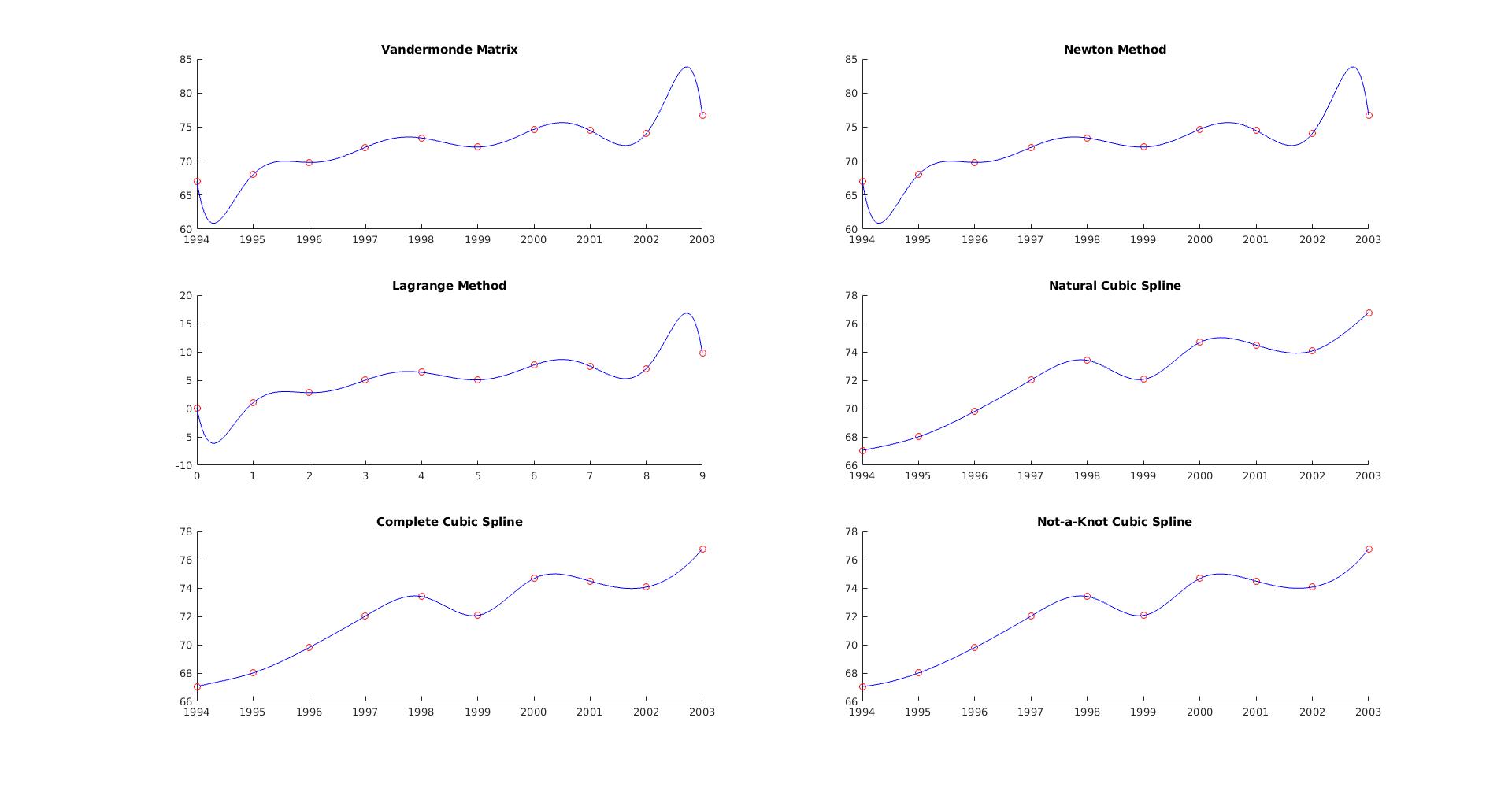
**Part B**

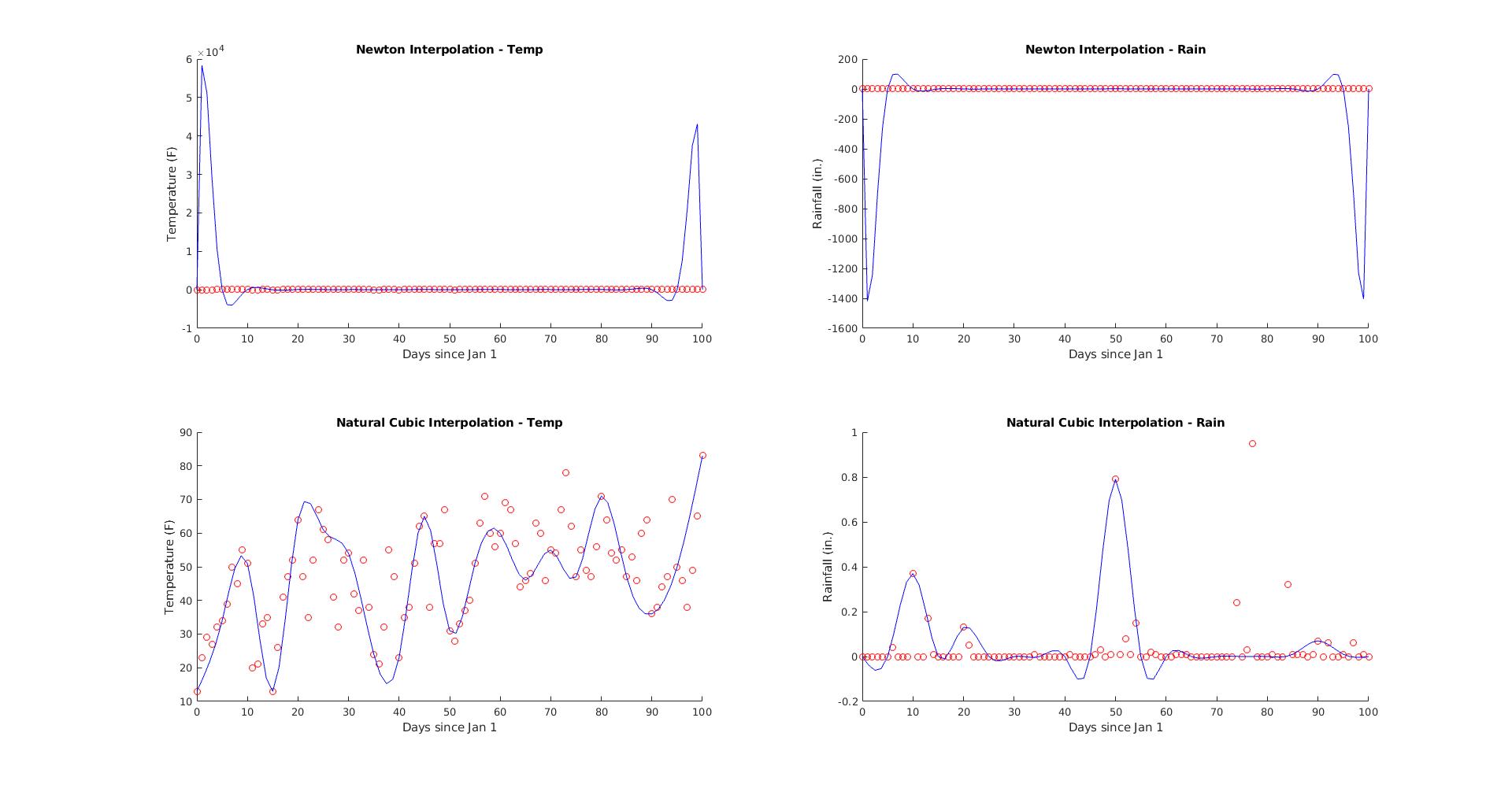
Dataset 1

**Part B**

Dataset 2

**Part B**

Dataset 3

**Part C**

**Data Set 1**

**f(x) = e^x^2 on [.6,1] with 5 Equally Spaced Points**

*Initial Analysis* ***-*** *Very few points, and a very simple function. I should expect little problems with interpreting this data.*

**Vandermonde:**

Accuracy - With only 5 points of data Vandermonde will be pretty accurate, as the degree is still low so there is little effect yet… on the conditionality of the matrix.

Efficiency - Costly Operations uses a complexity of O(N^2), Vandermonde will always be a high cost.

**Newton:**

Accuracy - Newton on the other hand benefits from having a larger pool of data for higher accuracy.

Efficiency - Newton tends to be more efficient than Vandermonde. Still has a complexity of O(n^2)

**Lagrange:**

Accuracy - Pretty accurate, but would be more accurate needs with more than 5 data points, however with the identity matrix it results in very little error. Could have a moment where it is divided by zero.

Efficiency - Extremely Expensive to solve the Lagrange Matrix no matter the size

**Natural Cubic Spline:**

Accuracy - zero values are being set to the second derivative values which doesn't match the values that the function may be measuring. S

Efficiency - Generally pretty efficient, comparatively more efficient when compared to other algorithms when in terms of larger data sets

**Complete Cubic Spline:**

Accuracy - Pretty accurate approximations, with a small data set it could be more reliable with more data points

Efficiency - Generally pretty efficient, comparatively more efficient when compared to other algorithms when in terms of larger data sets

**Not-A-Knot Spline:**

Accuracy - Better than the natural cubic spline in terms of accuracy.

Efficiency - Generally pretty efficient, comparatively more efficient when compared to other algorithms when in terms of larger data sets

**Data Set 2**

**f(x) = 1/(1+12X^2) on [-1,1] with 15 Equally Spaced Points**

*Initial Analysis - More points, and a more complicated function. I should expect some more problems with interpreting this data.*

**Vandermonde:**

Accuracy - Becomes increasingly ill-conditioned with more points of data. This is due to the residual of the linear system

Efficiency - The computational cost also increases significantly. As the Vandermonde Matrix becomes more ill-conditioned as degree is increasing

**Newton:**

Accuracy - When compared to Vandermonde and Lagrange, Newton is still the most stable choice. Newton is pretty accurate with more points.

Efficiency - Cost is increased because more operations are needed but is a 1 for 1 relationship and is balanced.

**Lagrange:**

Accuracy - Identity Matrix still makes it relatively accurate except at the end of the matrix. Falls into the risk of a divide by zero.

Efficiency - Absolutely off the charts, as more points are added Lagrange becomes intense to calculate.

**Natural Cubic Spline:**

Accuracy - More accurate with more data points given.

Efficiency - Cubic Splines are still efficient of an option to go with to solve. However, it does cost quite a significant amount more to solve

**Complete Cubic Spline:**

Accuracy - Accurate at the endpoints at an arbitrary point

Efficiency - Cubic Splines are still efficient of an option to go with to solve. However, it does cost quite a significant amount more to solve

**Not-A-Knot Spline:**

Accuracy - More accurate than Natural, but captures the third derivative of the spline to be continuous at the X.

Efficiency - Cubic Splines are still efficient of an option to go with to solve. However, it does cost quite a significant amount more to solve

**Data Set 3**

**Years - 1994 - 2003**

*Initial Analysis - Consistent number of points however, the points can vary a little more should see some deviations in the accuracy.*

**Vandermonde:**

Accuracy - Becomes increasingly ill-conditioned with more points of data. End points are less accurate

Efficiency - The computational cost also increases significantly. As the Vandermonde Matrix becomes more ill-conditioned as degree is increasing. Getting the squares of so many of these large numbers and square roots can result in some serious approximation issues.

**Newton:**

Accuracy - However when compared to Vandermonde and Lagrange, Newton is still the most stable choice. It still lacks in accuracy at the two endpoints as well.

Efficiency - Cost is incremental and is moderately balanced. Less chance of overflow however.

**Lagrange:**

Accuracy – Lagrange accuracy is still extremely high, however never the forget that it comes at a great cost in particular.

Efficiency - Absolutely off the charts, as more points are added Lagrange becomes intense to calculate. Especially considering the larger numbers there will be more added problems when multiplying these numbers together.

**Natural Cubic Spline:**

Accuracy - More accurate with closer data points given. With a smaller deviation. With the data points with yearly differences there could be more fluctuation in the cubic splines.

Efficiency - Cubic Splines are still efficient of an option to go with to solve. However, it does cost quite a significant amount more to solve

**Complete Cubic Spline:**

Accuracy - More accurate with closer data points given. With a smaller deviation. With the data points with yearly differences there could be more fluctuation in the cubic splines.

Efficiency - Cubic Splines are still efficient of an option to go with to solve. Clamped will approach the end points at a better solution

**Not-A-Knot Spline:**

Accuracy - More accurate with closer data points given. With a smaller deviation. With the data points with yearly differences there could be more fluctuation in the cubic splines.

Efficiency - Cubic Splines are still efficient of an option to go with to solve. However, it does cost quite a significant amount more to solve

Common Patterns I observed:

Vandermonde would be a better fit for a small data set and a quick solution but inaccurate solution.

Newton is the best all around decision with a incremental cost for efficiency but accuracy remains relatively stable due to its reliance on previous inputs and lower triangular solution.

Lagrange has the most accurate solution, but its just so costly and there are risks associated like a divide by zero it should remain as just a theoretical concept.

Cubic Splines are all round good choices certain ice cream flavors makes slight differences between the three, but hey… its Ice Cream so who’s going to complain? Unless its banana, banana sucks.