Problem Set 5 Latex Report

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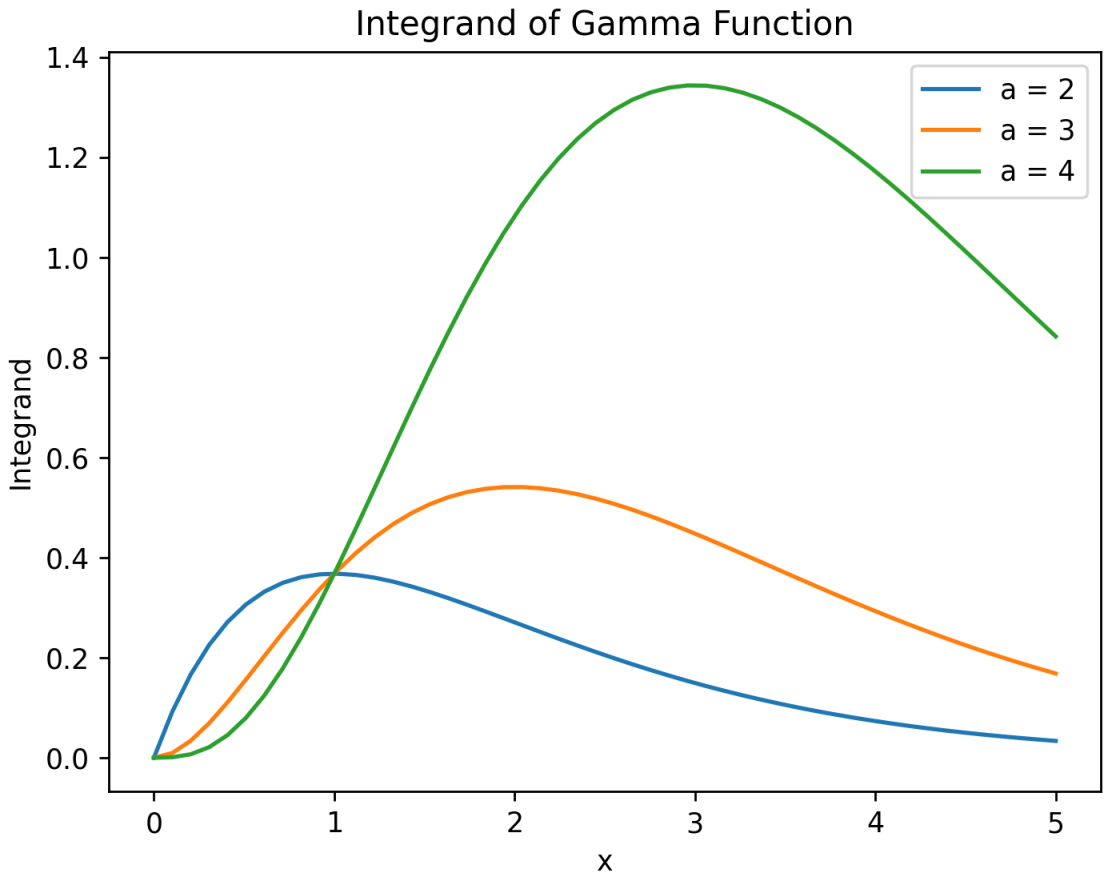
1 Problem 1

1.1 Part a



We can see that as gamma gets larger the maximum moves further away from 0

1.2 Part b

To show the maximum, we take the derivative of the integrated.

$$\frac{df}{dx} = e^{-x}x^{a-1} * (\frac{a-1}{x} - 1)$$

Equating the derivative to 0, we get that $x = a - 1$.

1.3 Part c

$$z = \frac{x}{c+x}$$

$$\frac{1}{2} = \frac{a-1}{c+a-1}$$

$$c = a - 1$$

1.4 Part d

$$f(x) = e^{(a-1)lnx-x}$$

1.5 Part e

As expected our gamma(1.5) turned out to be 8862269

1.6 Part f

The difference between gamma(a) and a-1 factorial was zero

2 Problem 2

2.1 Plot of the Data

2.2 Using SVD to fit a 3rd order Polynomial

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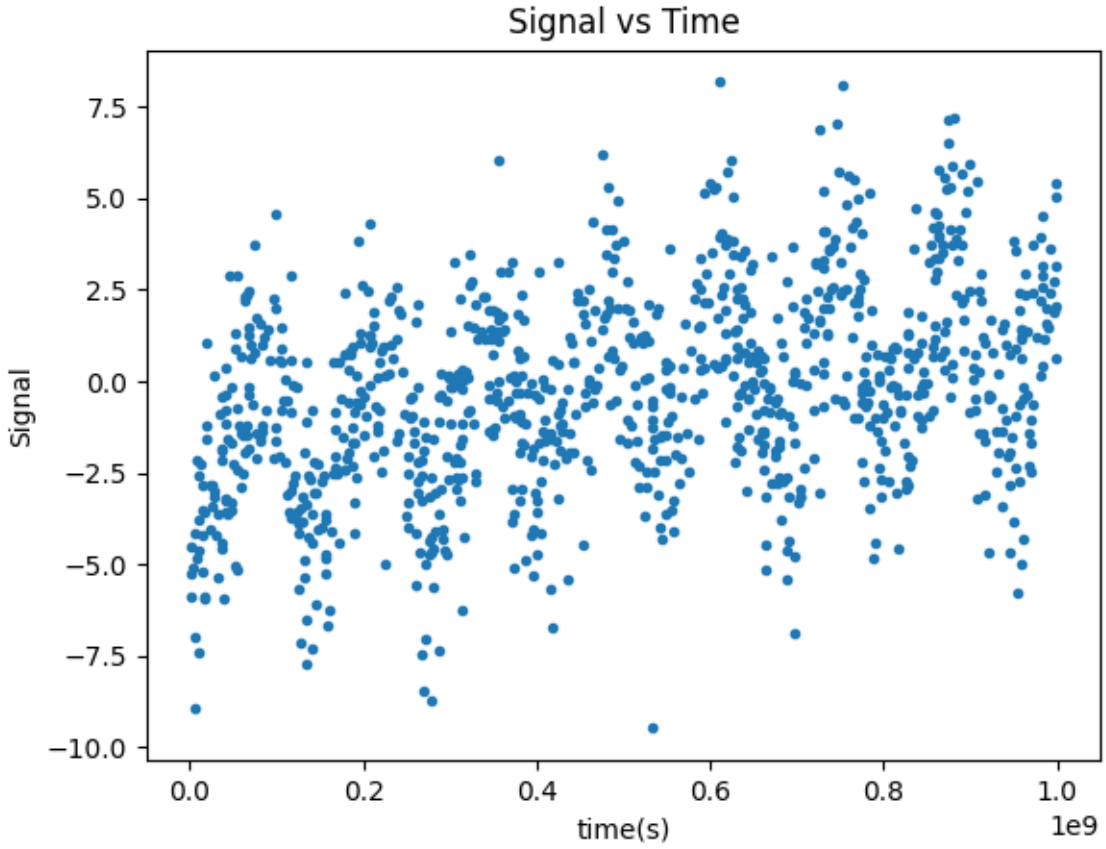
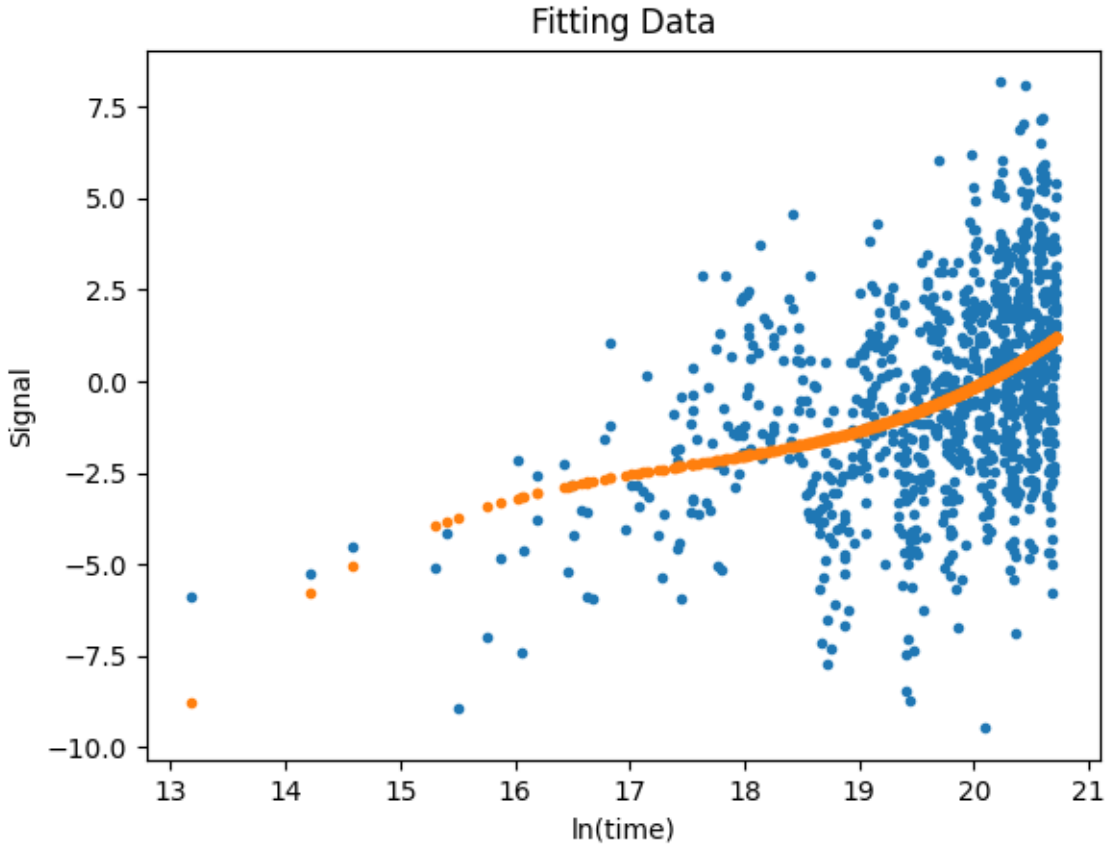
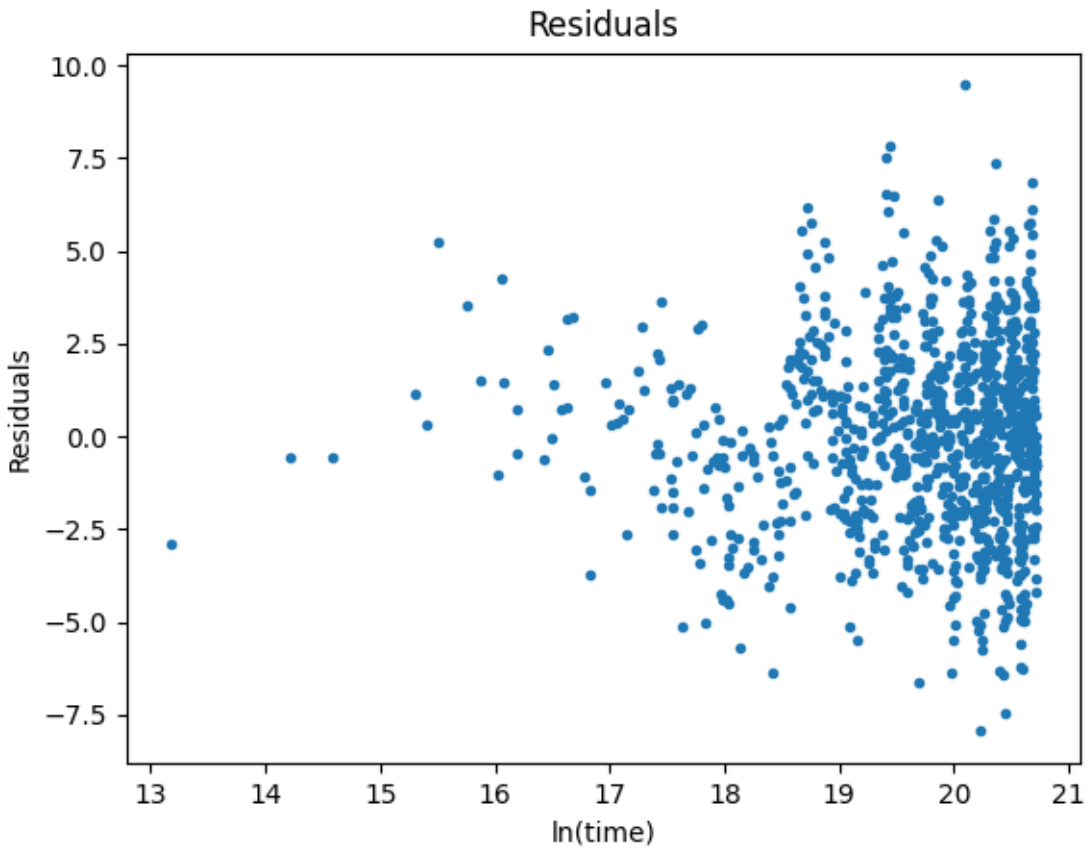
2.3 Using higher order polynomial

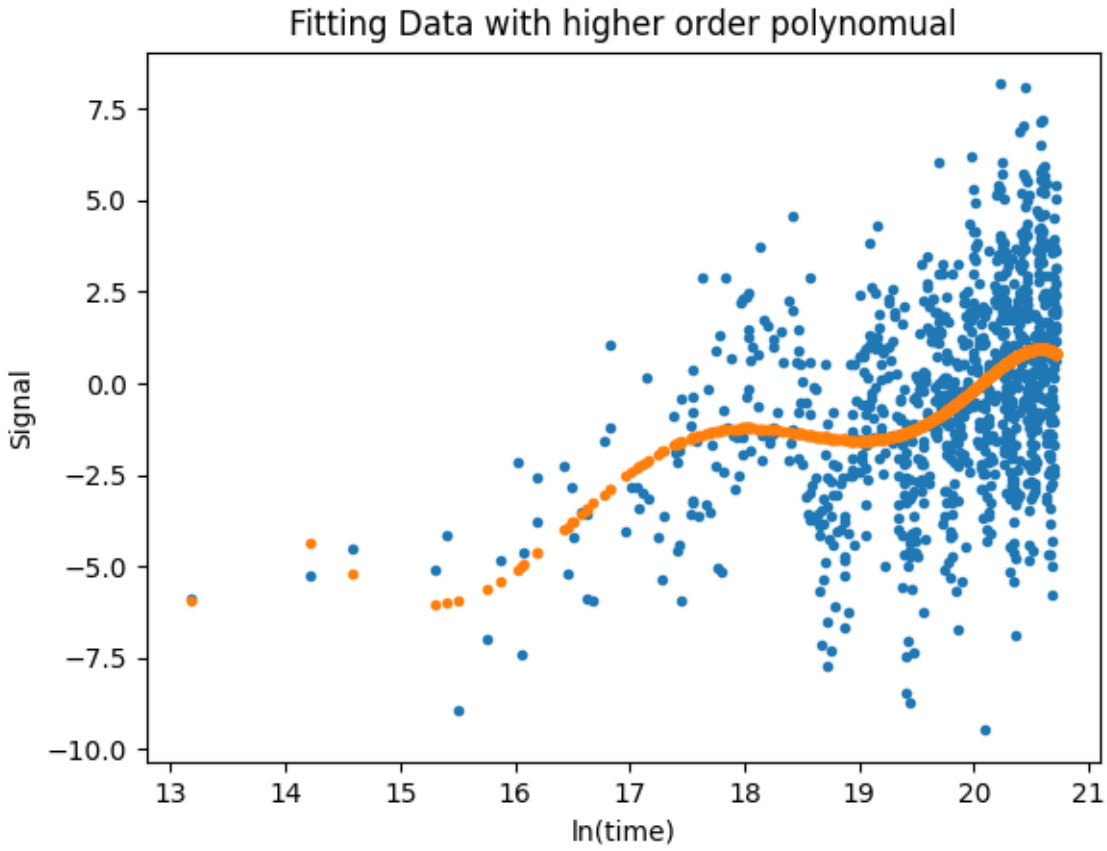
2.4 Fitting With sines and cosines

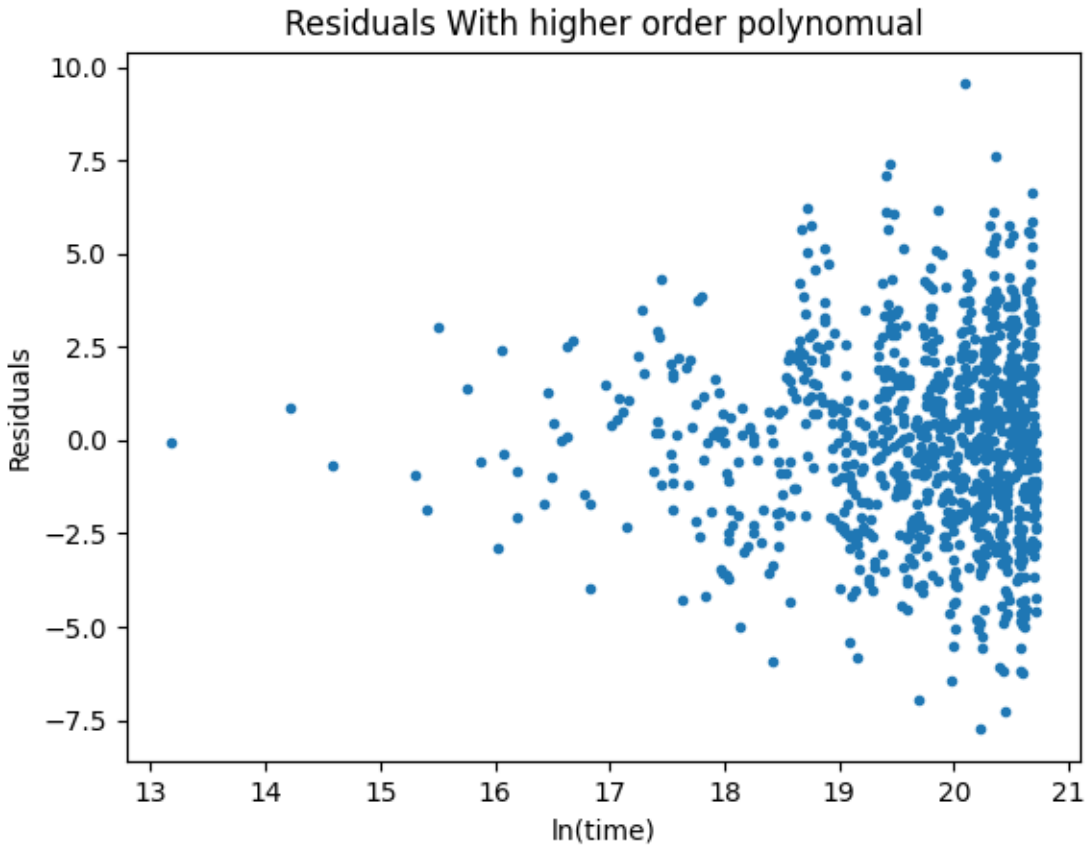

Signal vs Time
Signal
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
−10.0
0.0
0.2
0.4
0.6
0.8
1.0
time(s)
1e9


Fitting Data
Signal
ln(time)
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
−10.0
13
14
15
16
17
18
19
20
21

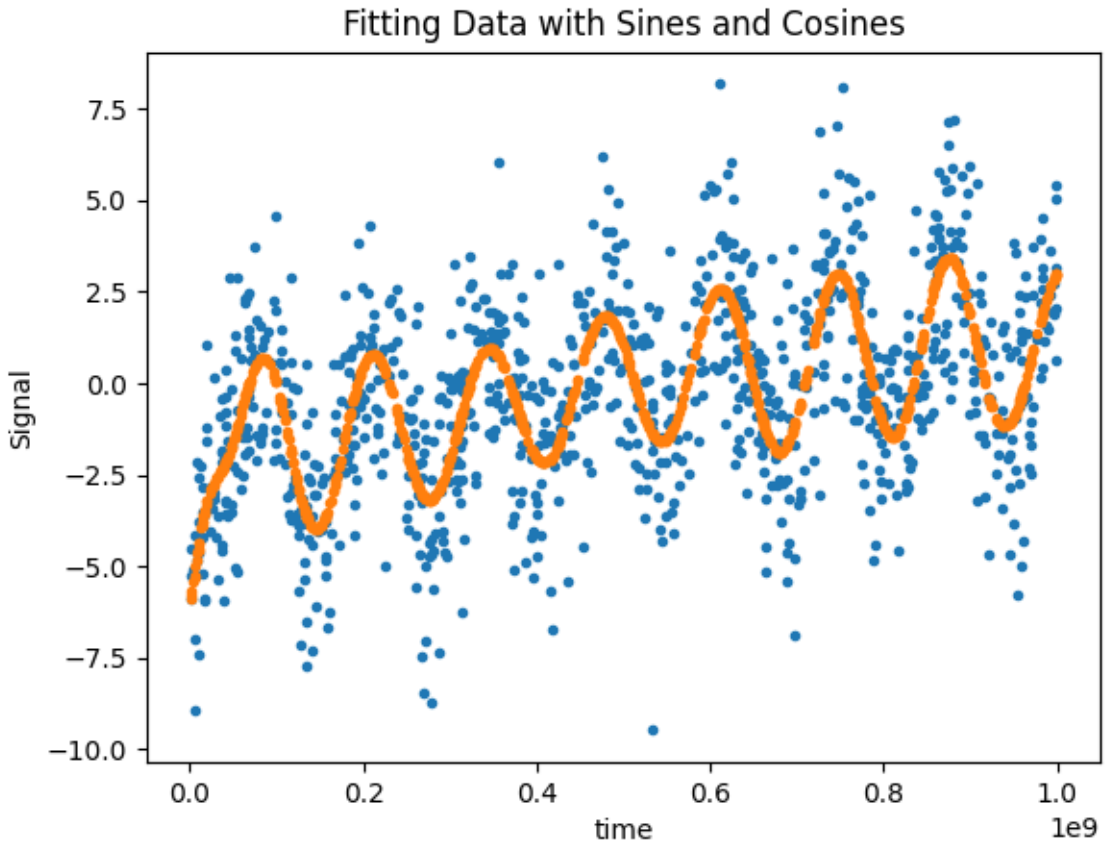


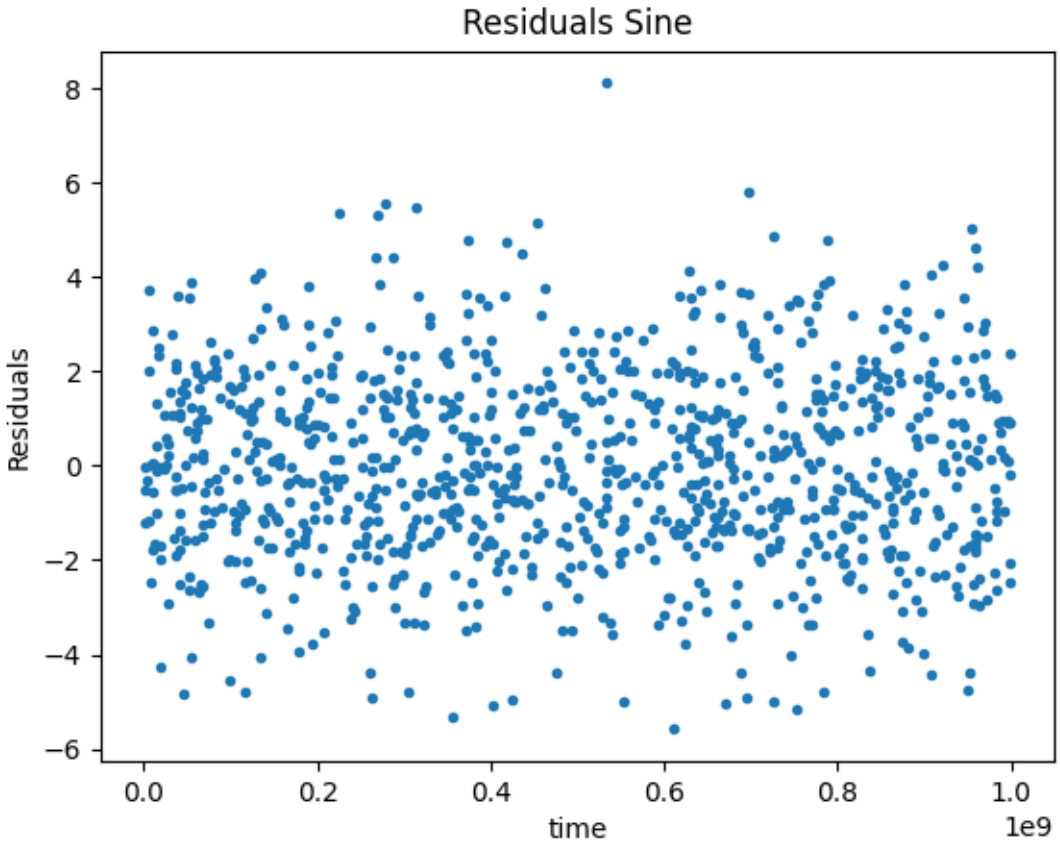
To scale the time, the natural log was used. The third-order polynomial was not the best fit.


Fitting Data with higher order polynomual
Signal
ln(time)
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
−10.0
13
14
15
16
17
18
19
20
21



Even though a higher-order polynomial was used, it did not affect the residuals significantly. No other polynomial would fit this data better because the condition number becomes unreasonably large.


Fitting Data with Sines and Cosines
Signal
time
1e9
7.5
5.0
2.5
0.0
−2.5
−5.0
−7.5
−10.0
0.0
0.2
0.4
0.6
0.8
1.0



When the sines and cosines are fit the residuals are smaller and uniform indicating that fitting with harmonics is a good idea.