

Least squares approximation

I. Find an elliptic orbit

$$ax^2 + bxy + cy^2 + dx + ey + 1 = 0$$

which is the best fit to observed planet coordinates in an ascii file `xy1.dat` in the xy plane. Save this file to your directory. To use the data in Matlab computations you can load the data as follows:

```
>>load xy1 -ascii; x=xy1(:,1); y=xy1(:,2);
```

II. The matrix $[x,y]$ in an ascii file `xy2.dat` contains measurements of y for different values of x . Which of the two nonlinear models provides for a better least squares fit to these data?

$$(a) \quad y \approx \tan(a \exp(-t^2) + b), \quad (b) \quad y \approx a \exp(b/(t + 0.5)).$$

To answer these questions you should approximate the data by each of the models (use Matlab) and compare the values of $\sum(\Delta y_i)^2$. Use data transformations to simplify the fitting. Present graphs showing the data and the best fit curve for each model.

III. Find the parameters c_1, \dots, c_5 which provide the best fit of the data in `xy3.dat` if the model is

$$y_i \approx \frac{c_1 + c_2 x_i + c_3 x_i^2}{1 + c_4 x_i + c_5 x_i^2}.$$

Use data transformations to simplify the fitting.