Exercises for Practical #4 - Advanced Topics

In this practical you will start to use some of the more advanced builtin MATLAB routines and plotting features.

- 1. Use Matlab to randomly determine which of these questions you attempt first.
- 2. Compute both the integral and maximum of $f = \sin(x) + \sin(x^2)$ on the interval [0, 10]. Adjust the tolerances to convince yourself that you have computed the first 10 digits accurately.

Locate also three of the roots of the same function f on [0, 10].

- 3. (Tricky) For what values of a does $I(a) = \int_{-1}^{1} (\sin(x) + \sin(ax^2)) dx = 1$?
- 4. (Hard) Fit the data from census to a curve of the form

$$c_1 + c_2 \exp(c_3 t)$$

and predict when the population of the U.S. will reach 500 million.

5. Find the roots of

$$P(x) = 50 + 610x - 290x^2 - 1625x^3 + 225x^4 + 1030x^5$$

using first the roots command and then fzero.

- 6. Implement a bisection algorithm to find the roots of the polynomial above.
- 7. Integrate $y \sin(x) + x \cos(y)$ over $\pi \le x \le 2\pi, 0 \le y \le \pi$.
- 8. Compute the 10^{th} root of $J_0(x)$ The 0^{th} -order 1^{st} -kind Bessel function (besselj(0,x)).
- 9. Solve the initial value problem $\frac{dx}{dt}(t)=tx(t),\ x(0)=1$ on the interval $t\in[0,2]$ using ode23 and ode45. Evaluate your solution at t=1.
- 10. Solve the boundary value problem $y'' + y'(1 y^2) = 0$, y(0) = -1, y(1) = 1 using bvp4c and bvp5c. Find where y(x) = 0.5.