Mathieu's Equation

Remark: Before proceeding, we recommend that you familiarize yourself with the basics of XPP syntax via the introductory examples `ch1-riccati.ode` *and* `ch1-van-der-Pol.ode` *from Chapter 1 and their accompanying documentation.*

The plain text file `ch3-mathieu.ode` is an XPP script for numerical solution of the Mathieu equation which, written as a system of first-order ODEs, takes the form

$$
\begin{aligned}
x' &= y \\
y' &= -\left(\kappa + 2\epsilon \cos t\right) x
\end{aligned}
$$

where κ and ϵ are parameters. See the Exercises at the end of Chapter 3 in our textbook.

The default parameter values, initial conditions, and viewing window are all specified in the `ch3-mathieu.ode` file. There are a couple of other settings that appear in that file as well. The `bound=10000` setting tells XPP to stop computing the solution further forward in time if $|x(t)|$ or $|y(t)|$ ever exceeds 10000. The command `maxstor = 100010` allows XPP to generate and store as many as 100010 data points in approximating the solution of an initial value problem. In the absence of this instruction, the default value of `maxstor` is 5000. When examining the [numerical] solution of the above Mathieu equation, you may need to extend the solution to long time scales to observe key behavior. (For example, using Euler's method with a time step of `dt = 0.01` over an interval of total length `total=1000` would generate 100000 data points.)