Problem 5
Consider the so called van der Pol equation

\[
\dot{x}(t) = v(t), \quad \dot{v}(t) = -x(t) + v(t) \left(1 - x^2(t)\right).
\]

One can show that solutions with initial conditions in an annulus, i.e. initial conditions which obey the inequality \(\delta < \sqrt{x_0^2 + v_0^2} < R\) where \(\delta\) is a small number, say \(\delta = 1/10\), and \(R\) a large number, say \(R = 10\), generate orbits which stay within such an annulus, i.e. \(\delta < \sqrt{x(t)^2 + v(t)^2} < R\). What can you say about the long time behaviour of such solutions (i.e. about the \(\omega\)-limit set).

Problem 6
Consider the map \(f_a : \mathbb{R} \rightarrow \mathbb{R}\) given by

\[
f_a(x) = a/(a^2 + x^2)
\]

where \(a \in \mathbb{R}\) denotes the parameter of the map. Determine a range of parameter values such that all orbits of the map converge to the unique fixed point.