Population models

Throughout, \( r \) is a positive constant and only \( N \geq 0 \) need be entertained.

\#1-\#4: find equilibrium solutions, determine the ranges over which solutions are increasing/decreasing, and sketch the graphs of representative solutions.

\#5-\#6: In these simple ‘harvesting’ models, can the population be driven to extinction?

1. \( \frac{dN}{dt} = -rN(1 - \frac{N}{K}) \) with \( K > 0 \).
2. \( \frac{dN}{dt} = rN(1 - \frac{N}{K})^2 \) with \( K > 0 \).
3. \( \frac{dN}{dt} = -rN(1 - \frac{N}{K})^2 \) with \( K > 0 \).
4. \( \frac{dN}{dt} = r(N - k)(1 - \frac{N}{K}) \) with \( K > k > 0 \).
5. \( \frac{dN}{dt} = rN - hN \) with \( h > 0 \).
6. \( \frac{dN}{dt} = rN - h \) with \( h > 0 \).