Exercise 2: Consumer-Resource model with Type I functional response

We are now moving on to a two-dimensional system describing consumer (C) and resource (R) dynamics over time, using two functions we will refer to as f_R and f_C :

$$f_R = \frac{dR}{dt} = rR(1 - \frac{R}{K}) - aCR$$

$$f_C = \frac{dC}{dt} = eaCR - mC$$

where r is the resource population growth rate, K is resource carrying capacity, a is consumer attack rate, e is energy conversion efficiency and m is consumer mortality.

To do by hand (symbolically):

- 1. Solve for all equilibria and isoclines
- 2. Plot the isoclines in state space
 - ⇒ draw trajectories directly on the clines
 - ⇒ fill out the vector field throughout the state space
- 3. Take the partial derivatives of f_R and f_C to calculate the Jacobian matrix
 - ⇒ substitute each equilibrium in for R and C
- 4. Calculate the eigenvalues for each equilibrium using the characteristic equation
- * Remember to refer to the "Getting Started" notes if you have any questions about these steps.

To do using code:

Once you have done this by hand, you can confirm your answers using code.

- 1. Take the notebook you already have (the L-V competition model we've been working with), in whatever coding language you'd like, and convert it to this C-R model.
 - ⇒ This should be as simple as changing the functions, but you will need to alter the parameter list and may want to re-name the state variables.
- 2. Confirm the symbolic solutions you calculated by hand
- 3. To plot the isoclines you will need to define a parameter set, but this will be a good opportunity to become familiar with the "Manipulate" function

Next week we will go through the hand-written answers and answer anyone's coding questions.