After non-dimensionalisation (**Exercise**):

$$\frac{du}{d\tau} = u(1-u) - \frac{auv}{d+u}, \tag{3.20}$$

$$\frac{dv}{d\tau} = bv(1 - \frac{v}{u}). \tag{3.21}$$

where a, b, d are positive constants.

3.3.1 Steady States and Linear Stability Analysis

Steady states: $(u_s, v_s) = (0, 0)$.

Note: $u_s = 1$, $v_s = 0$ is also a st.st. which is a saddle (unstable)

Non-trivial steady states: (u_s, v_s) satisfy

$$v_s = u_s \quad \text{where} \quad (1 - u_s) = \frac{au_s}{d + u_s}. \tag{3.22}$$

$$\begin{vmatrix} -1-\lambda & -\frac{a}{d+1} \\ 0 & b-\lambda \end{vmatrix}$$

and hence

$$u_s = \frac{1}{2}\left[-(a+d-1) + \sqrt{(a+d-1)^2 + 4d}\right]. \tag{3.23}$$

$\Rightarrow \lambda = b, -1$.

is the only positive steady state.