

Assignment 3, MATH 6104

1. Consider the Ross-Macdonald ODE model of the malaria transmission:

$$\begin{aligned}h' &= ab\frac{H-h}{H}v - d_h h \\v' &= ac\frac{h}{H}(M-v) - d_v v,\end{aligned}\tag{1}$$

where h and v are the numbers of infective humans and mosquitoes, d_h and d_v are the mortality rates of the humans and mosquitoes, H and M are the total numbers of humans and mosquitoes, respectively; a is the mosquito biting rate, b and c are the transmission probabilities from infectious mosquitoes to humans and from infectious humans to mosquitoes, respectively. Find the basic reproduction number R_0 for model (1), and then establish a threshold type result on its global dynamics in terms of R_0 .

2. For the spatial model of rabies proposed in [Murray, Stanley and Brown, Proc. Roy. Soc. London Ser. B, 1996], introduce the basic reproduction number R_0 and then prove that the disease-free steady state $(0, 0, K)$ is a weak repeller provided that $R_0 > 1$.