

Math 36

Homework 02

Differential Equations: Arms Race Model

1. Consider the Richardson arms race model, without assumption 3 (i.e. the terms representing underlying grievances are both zero). What happens if the lines $\frac{dx}{dt} = 0$ and $\frac{dy}{dt} = 0$ coincide? Under what conditions can this happen? Does this require the corresponding parameters from each differential equation to match? What will the slope field look like? Describe the possible long-term behaviors mathematically, and interpret the results.
2. Consider the general form of the arms race model. Assume that the point of intersection of the lines $\frac{dx}{dt} = 0$ and $\frac{dy}{dt} = 0$ lies in the second quadrant of the xy -plane. Is it possible to have a stabilizing arms race in this case? Is it possible to have a runaway arms race? Give a set of parameter values that results in each possible case, and find the coordinates of the point of intersection. Interpret the situation that arises at this point.