MATH 246 Homework 3.10
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Directions:

- Work should be done neatly and on separate paper.
- Enough work must be shown so that the steps you are taking is clear.

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1. A competing species model is given by the following. Assume quantities are in thousands.

$$x' = (36 - 2x - 3y)x$$
$$y' = (24 - 2x - y)y$$

   (a) Find the stationary solutions and analyze the behavior around each.

   (b) Draw a reasonable family of solutions.

   (c) Describe (full sentences!) the various possible outcomes for a starting scenario where both populations are small.

   (d) If the populations are at the stationary solution in the first quadrant, why does it seem real-world reasonable that there are essentially two directions of instability? What do they correspond to?

2. A cooperating species model is given by the following. Assume quantities are in thousands.

$$x' = (27 - 3x + y)x$$
$$y' = (27 + 3x - 2y)y$$

   (a) Find the stationary solutions and analyze the behavior around each.

   (b) Draw a reasonable family of solutions.

   (c) Why does it seem real-world reasonable that a population such as $(1, 100)$ would undergo a massive decrease in y but with very little change in x before stabilizing?