Math 265 Linear Algebra

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Linear System of Differential Equations

- (EX) Let $x(t)$ and $y(t)$ be the populations of two competing species, bisens and elks at time t, respectively. Suppose that the initial populations are $x(0) = 200$, $y(0) = 100$. If the growth rates of the species are given by

$$dx/dt = x(t) - 2y(t),$$

$$dy/dt = -3x(t) + 2y(t).$$

Find the population of each species at time t.

Example: Salt Solution

(Ex) At time $t = 0$, a tank contains 5 lb of salt dissolved in 100 gal of (salt) water. Assume that water containing 1/4 lb/gal is entering tank at rate of 2 gal/min, and leaves at same rate.

(a) Set up IVP that describes this salt solution flow process.

(b) Find amount of salt $Q(t)$ in tank at any given time t.

(c) Find limiting amount Q_L of salt $Q(t)$ in tank after a very long time.