**Homework 5 - Math 243** **Name:** ________________________

*Solve the following partially coupled systems analytically.*

1. insert!

2. insert

3. In the ocean, cod eat krill and seals eat both cod and krill. Write a system of three differential equations to model the populations of the krill $K$, the cod $C$, and the seals $S$. Use lower case letters for any constants you need and you can assume that the krill population would obey a constrained growth model (i.e., a logistic model) in the absence of predators.

*Find all equilibrium solutions for the following systems of equations.*

4.
$$\frac{dx}{dt} = x - 2y + 4$$
$$\frac{dy}{dt} = 2x + y - 7$$
.

5.
$$\frac{dR}{dt} = 5R - 0.5RF$$
$$\frac{dF}{dt} = -4F + 0.1RF$$
.

6. Consider the differential equation $\frac{dv}{dt} + 6v = e^{2t}$.

   (a) What is the corresponding homogeneous differential equation?

   (b) What is the general solution of the homogeneous differential equation?

   (c) Find one particular solution for the original equation of the form $v(t) = Ae^{2t}$. Then combine the particular solution and the homogeneous solution to express the general solution.

7. Consider the differential equation $\frac{dy}{dt} + y = 6\cos x$.

   (a) Find constants $A$ and $B$ such that $y(t) = A\cos t + B\sin t$ is a solution to this ODE.

   (b) Find the general solution of $\frac{dy}{dt} + y = 6\cos x$.