Mathematics 172 Homework

1. For the following system describing two competing species find the equilibrium points and classify as to stable or unstable. Describe if the x species dominates, the y species dominates, there is competitive exclusion, or competitive coexistence.

$$\frac{dx}{dt} = 0.12x \left(\frac{1600. - x - 1.6y}{1600.}\right)$$
$$\frac{dy}{dt} = 0.23y \left(\frac{800. - 1.3x - y}{800.}\right)$$

Answer: (0,0) is unstable. (1600,0) is stable, (0,800) is unstable. x-species dominates.

2. For the following system describing two competing species find the equilibrium points and classify as to stable or unstable. Describe if the x species dominates, the y species dominates, there is competitive exclusion, or competitive coexistence.

$$\frac{dx}{dt} = 0.12x \left(\frac{1600. - x - 0.90y}{1600.}\right)$$
$$\frac{dy}{dt} = 0.23y \left(\frac{2400. - 1.3x - y}{2400.}\right)$$

Answer: (0,0) is unstable. (1600,0) is unstable, (0,2400) is stable. y-species dominates.

3. For the following system describing two competing species find the equilibrium points and classify as to stable or unstable. Describe if the x species dominates, the y species dominates, there is competitive exclusion, or competitive coexistence.

$$\frac{dx}{dt} = 0.12x \left(\frac{1600. - x - 0.90y}{1600.}\right)$$
$$\frac{dy}{dt} = 0.23y \left(\frac{2000. - 1.7x - y}{2000.}\right)$$

Answer: (0,0) is unstable. (1600,0) is stable, (0,2000) is stable. (377.4,1358.) is unstable. Competitive exclusion.

4. For the following system describing two competing species find the equilibrium points and classify as to stable or unstable. Describe if the x species dominates, the \boldsymbol{y} species dominates, there is competitive exclusion, or competitive coexistence.

$$\frac{dx}{dt} = 0.62x \left(\frac{1600. - x - 0.90y}{1600.}\right)$$
$$\frac{dy}{dt} = 0.32y \left(\frac{1000. - 0.30x - y}{1000.}\right)$$

Answer: (0,0) is unstable. (1600,0) is unstable, (0,1000) is unstable. (958.9,712.3) is stable. Competitive exclusion.