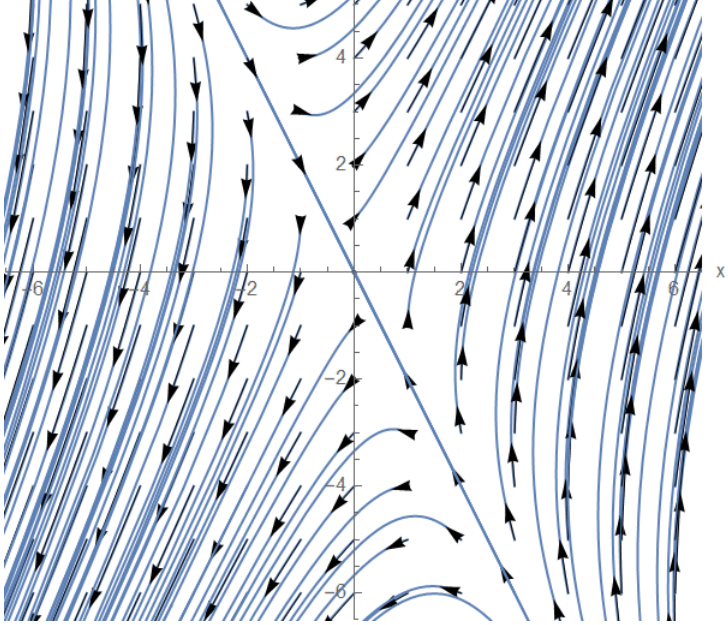

Figure 1: Phase Diagram_Exercise 2.a

Homework Set 4

1. a)

General Solution: $y_t = \mathrm{A}_1 e^{t} + \mathrm{A}_2 e^{0.5t} + (\frac{t^3}{3} - 2t^2 + 9t - 18)e^{t}$

1. b)

General Solution: $y_t = \mathrm{A}_1 e^{-t} + \mathrm{A}_2 t e^{-t} + t^2 - 4t + 6$

2. a)

General Solution:

$$x_t = \mathrm{A}_1 e^{3t} + \mathrm{A}_2 e^{-t}$$
$$y_t = \mathrm{A}_1 2e^{3t} + \mathrm{A}_2(-2)e^{-t}$$

2.b)

General Solution:

$$x_t = \mathrm{A}_1 2e^{2t} + \mathrm{A}_2 0.5e^{-t}$$
$$y_t = \mathrm{A}_1 e^{2t} + \mathrm{A}_2 e^{-t}$$

3)

The system of the two differential equations:

$$\dot{x} = -0.1x + 5\lambda$$
$$\dot{\lambda} = -\frac{20}{x} + 0.1\lambda$$

The fixed point of the system:

$$x^* = 100$$
$$\lambda^* = 2$$

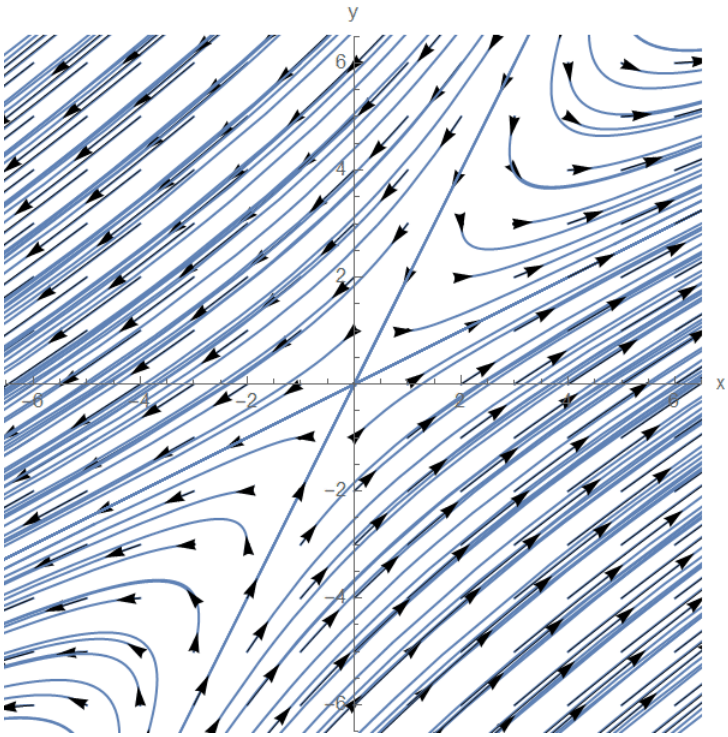

Figure 2: Phase Diagram_Exercise 2.b

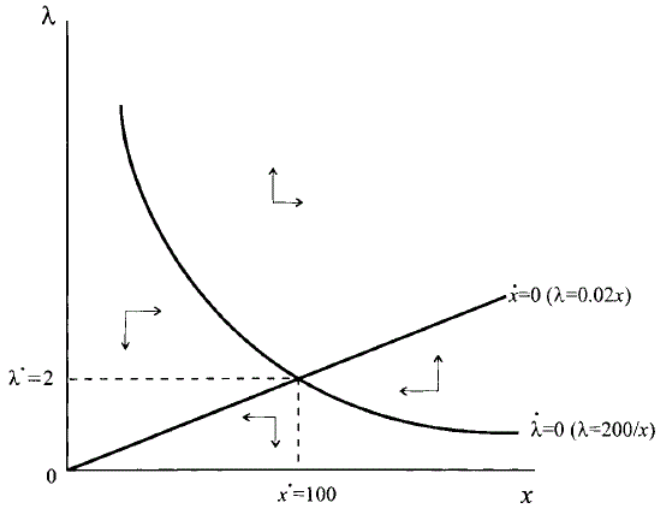

Figure 3: Phase Diagram_Exercise 3

The linearization of the system around the fixed point is:

$$\dot{x} = -0.1(x - x^*) + 5(\lambda - \lambda^*)$$
$$\dot{\lambda} = 0.002(x - x^*) + 0.1(\lambda - \lambda^*)$$