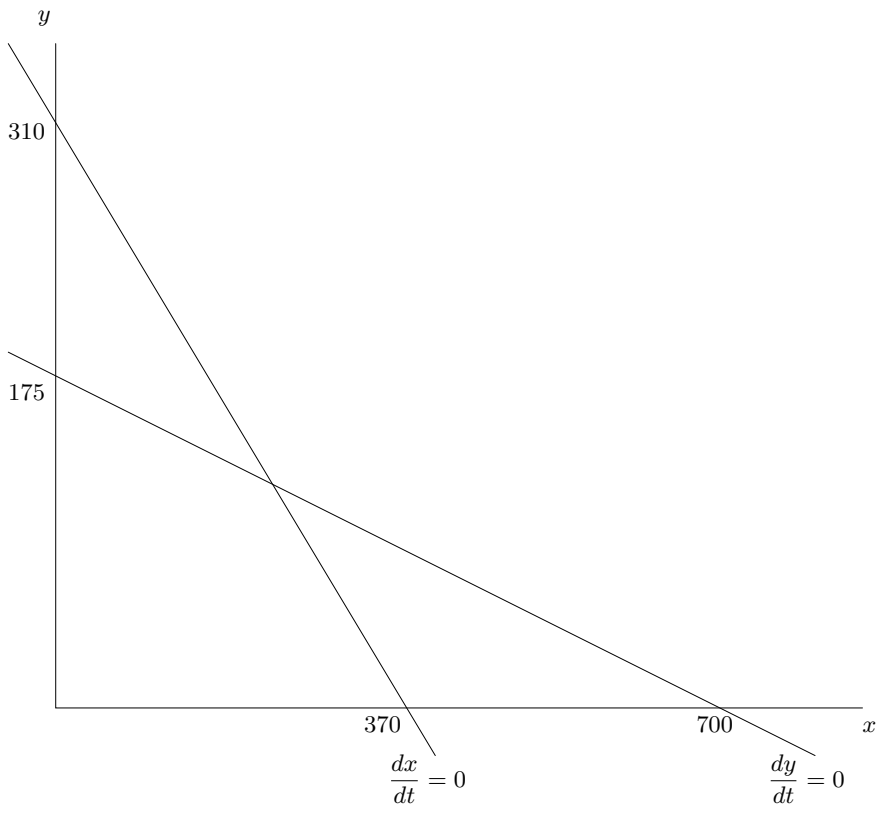
Mathematics 172 Homework.

Read pages 100–114 in the text. There are four problems here, followed by their answers.

1. If the phase diagram of for two competing species looks like:



(a) Label all the equilibrium points with a small circle ○.

(b) Draw in arrows that shows the direction that points in the phase space are moving.

(c) Use your answer to (b) to label all the equilibrium points as being either stable or unstable?

(d) If $x(0) = 400$ and $y(0) = 40$ estimate $x(75)$ and $y(75)$.

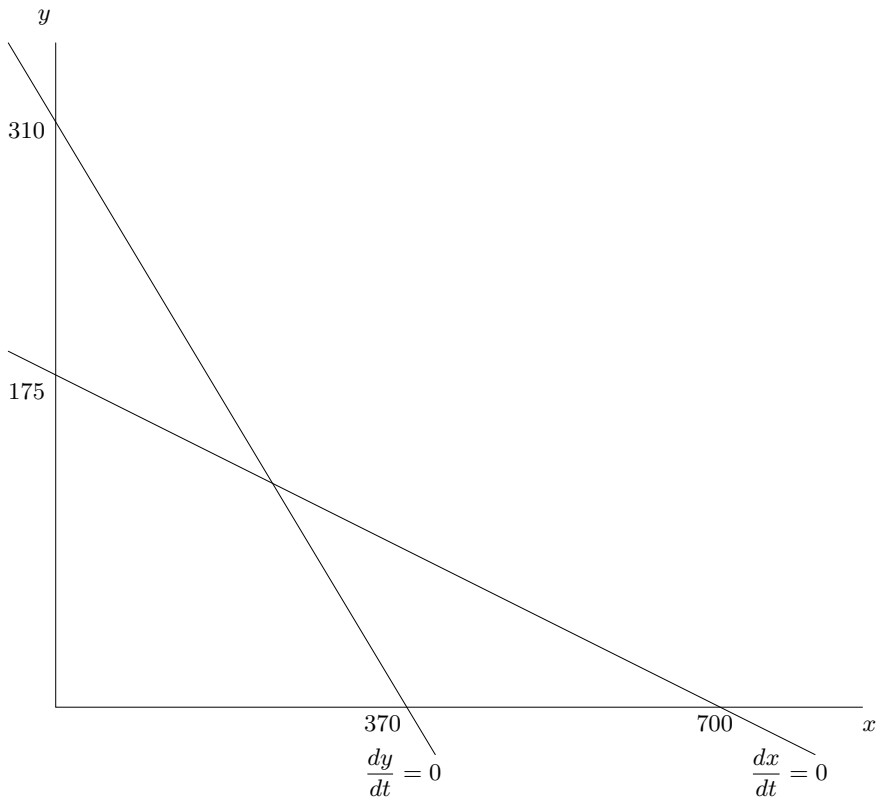
(e) If $x(0) = 20$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$.

(f) If $x(0) = 0$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$.

(g) If $x(0) = 450$ and $y(0) = 0$ estimate $x(75)$ and $y(75)$.

(h) Describe the long term behavior of the competition. That is competitive exclusion, competitive coexistence, species x dominates, or species y dominates.

2. If the phase diagram of for two competing species looks like:



(a) Label all the equilibrium points with a small circle ○.

(b) Draw in arrows that shows the direction that points in the phase space are moving.

(c) Use your answer to (b) to label all the equilibrium points as being either stable or unstable?

(d) If $x(0) = 400$ and $y(0) = 40$ estimate $x(75)$ and $y(75)$.

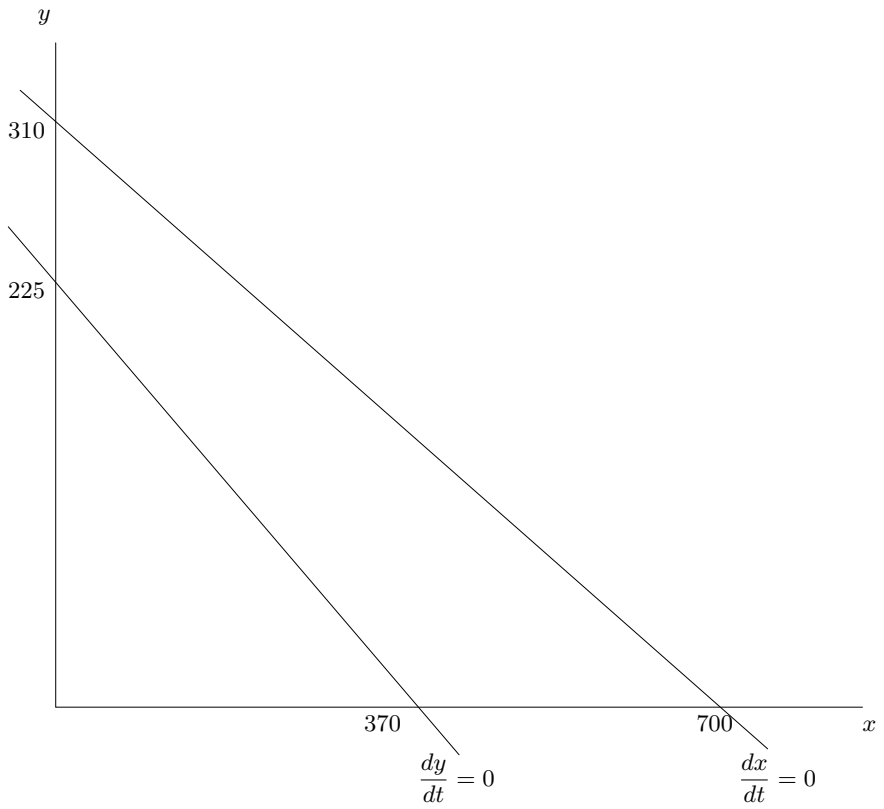
(e) If $x(0) = 20$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$.

(f) If $x(0) = 0$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$.

(g) If $x(0) = 450$ and $y(0) = 0$ estimate $x(75)$ and $y(75)$.

(h) Describe the long term behavior of the competition. That is competitive exclusion, competitive coexistence, species x dominates, or species y dominates.

3. If the phase diagram of for two competing species looks like:



(a) Label all the equilibrium points with a small circle ○.

(b) Draw in arrows that shows the direction that points in the phase space are moving.

(c) Use your answer to (b) to label all the equilibrium points as being either stable or unstable?

(d) If $x(0) = 400$ and $y(0) = 40$ estimate $x(75)$ and $y(75)$.

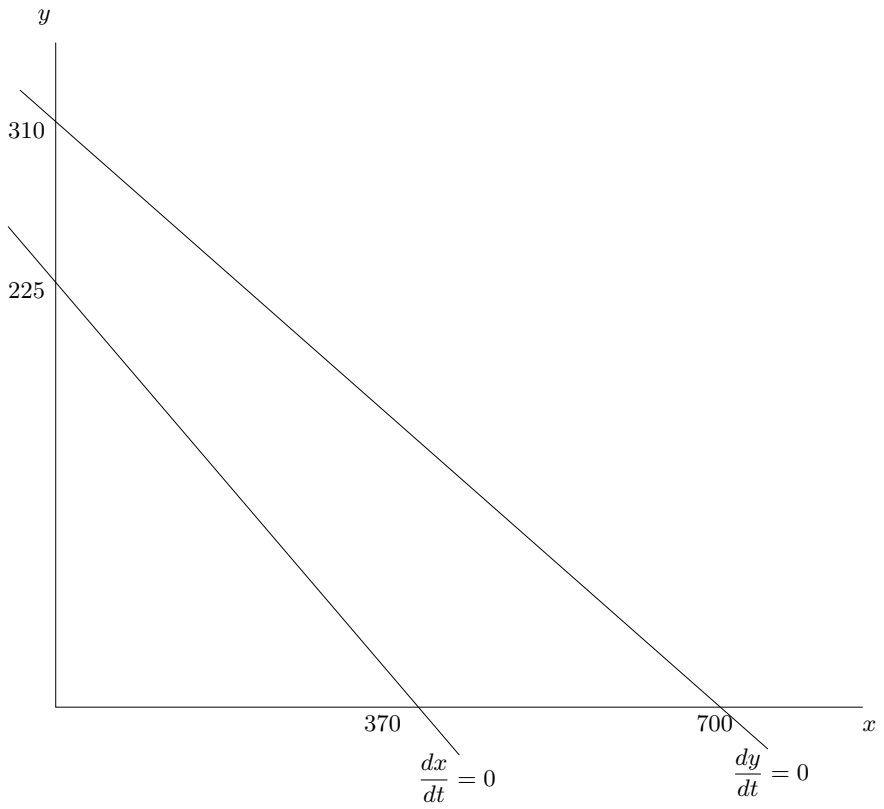
(e) If $x(0) = 20$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$.

(f) If $x(0) = 0$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$.

(g) If $x(0) = 450$ and $y(0) = 0$ estimate $x(75)$ and $y(75)$.

(h) Describe the long term behavior of the competition. That is competitive exclusion, competitive coexistence, species x dominates, or species y dominates.

4. If the phase diagram of for two competing species looks like:



(a) Label all the equilibrium points with a small circle ○.

(b) Draw in arrows that shows the direction that points in the phase space are moving.

(c) Use your answer to (b) to label all the equilibrium points as being either stable or unstable?

(d) If $x(0) = 400$ and $y(0) = 40$ estimate $x(75)$ and $y(75)$.

(e) If $x(0) = 20$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$.

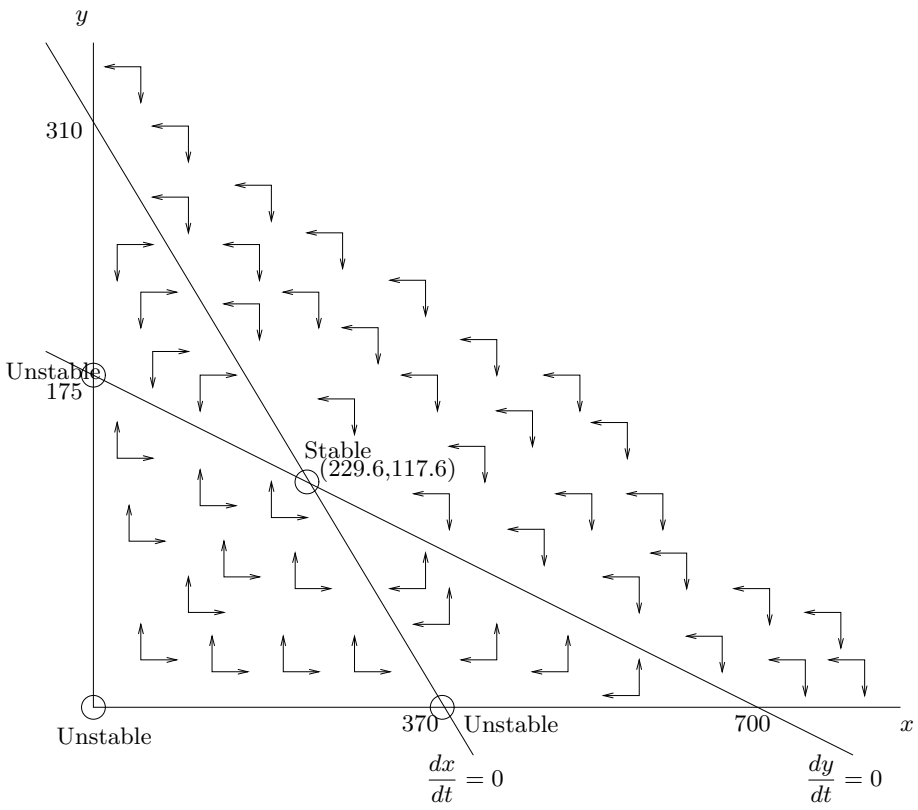
(f) If $x(0) = 0$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$.

(g) If $x(0) = 450$ and $y(0) = 0$ estimate $x(75)$ and $y(75)$.

(h) Describe the long term behavior of the competition. That is competitive exclusion, competitive coexistence, species x dominates, or species y dominates.

Answers

1. If the phase diagram of for two competing species looks like:



(a) Label all the equilibrium points with a small circle ○.*Answer:* See figure.

(b) Draw in arrows that shows the direction that points in the phase space are moving.*Answer:* See figure.

(c) Use your answer to (b) to label all the equilibrium points as being either stable or unstable? *Answer:* See figure.

(d) If $x(0) = 400$ and $y(0) = 40$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 229.6$ and $y(75) \approx 117.6$

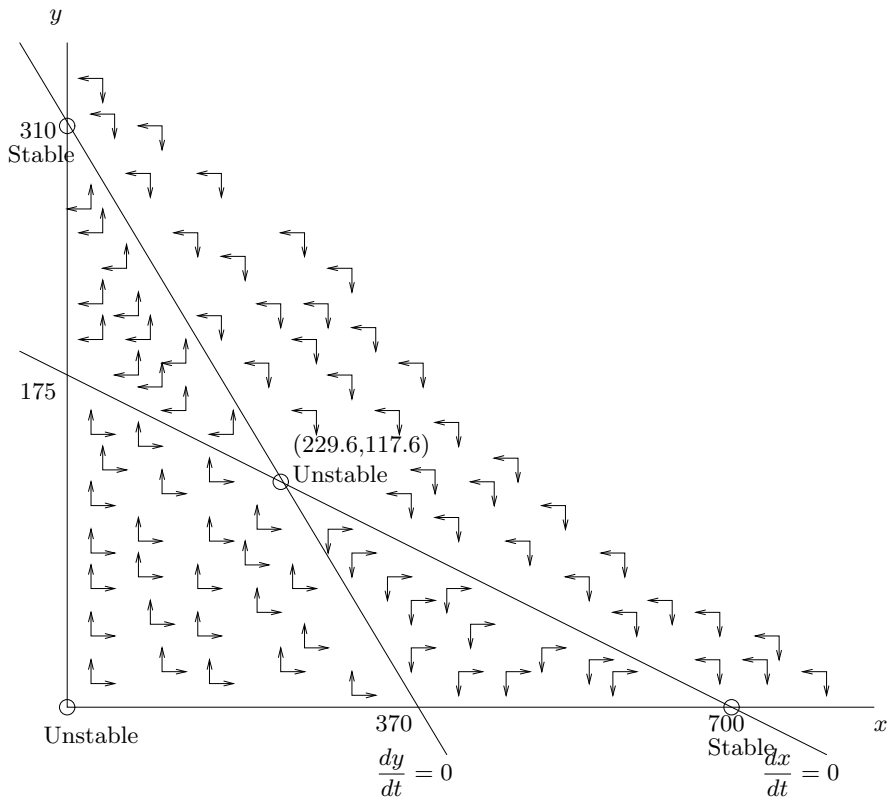
(e) If $x(0) = 20$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 229.6$ and $y(75) \approx 117.6$

(f) If $x(0) = 0$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) = 0$ and $y(75) = 175$.

(g) If $x(0) = 450$ and $y(0) = 0$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) = 370$ and $y(75) = 0$.

(h) Describe the long term behavior of the competition. That is competitive exclusion, competitive coexistence, species x dominates, or species y dominates. *Answer:* Competitive coexistence

2. If the phase diagram of for two competing species looks like:



(a) Label all the equilibrium points with a small circle ○. *Answer:* See figure. (b) Draw in arrows that shows the direction that points in the phase space are moving. *Answer:* See figure.

(c) Use your answer to (b) to label all the equilibrium points as being either stable or unstable? *Answer:* See figure.

(d) If $x(0) = 400$ and $y(0) = 40$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 700$ and $y(75) \approx 0$.

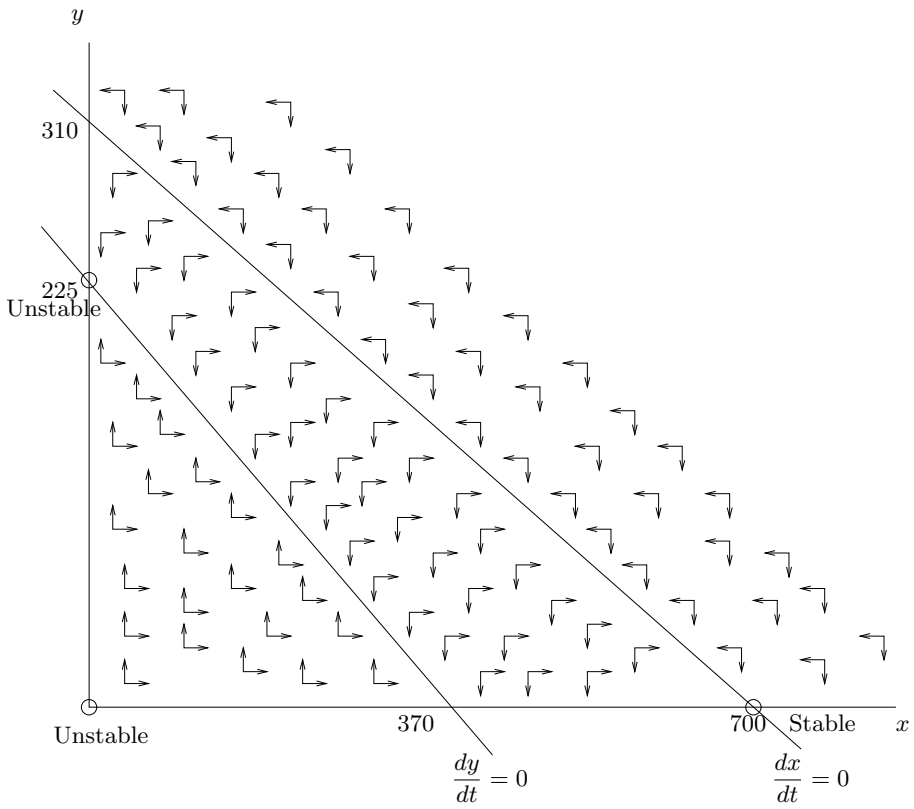
(e) If $x(0) = 20$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 0$ and $y(75) \approx 310$.

(f) If $x(0) = 0$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 0$ and $y(75) \approx 310$.

(g) If $x(0) = 450$ and $y(0) = 0$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 700$ and $y(75) \approx 0$.

(h) Describe the long term behavior of the competition. That is competitive exclusion, competitive coexistence, species x dominates, or species y dominates. *Answer:* Competitive exclusion.

3. If the phase diagram of for two competing species looks like:



(a) Label all the equilibrium points with a small circle ○. *Answer:* See figure.

(b) Draw in arrows that shows the direction that points in the phase space are moving. *Answer:* See figure.

(c) Use your answer to (b) to label all the equilibrium points as being either stable or unstable? *Answer:* See figure.

(d) If $x(0) = 400$ and $y(0) = 40$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 700$ and $y(75) \approx 0$.

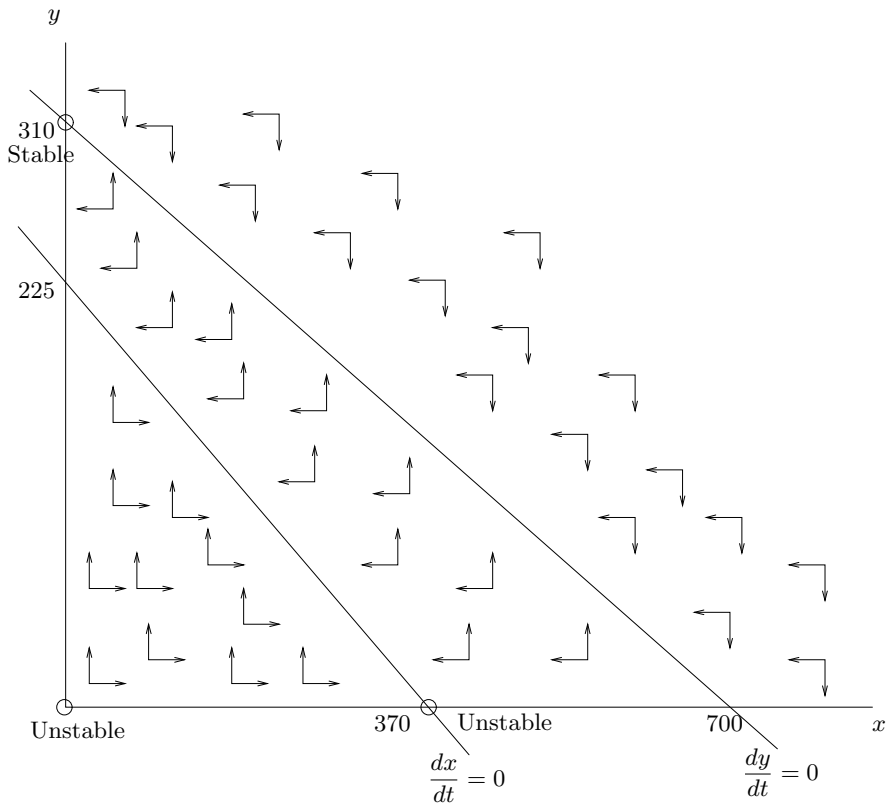
(e) If $x(0) = 20$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 700$ and $y(75) \approx 0$.

(f) If $x(0) = 0$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx$ and $y(75) \approx 225$.

(g) If $x(0) = 450$ and $y(0) = 0$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 700$ and $y(75) \approx 0$.

(h) Describe the long term behavior of the competition. That is competitive exclusion, competitive coexistence, species x dominates, or species y dominates. *Answer:* The species x dominates.

4. If the phase diagram of for two competing species looks like:



(a) Label all the equilibrium points with a small circle ○. *Answer:* See figure.

(b) Draw in arrows that shows the direction that points in the phase space are moving.*Answer:* See figure.

(c) Use your answer to (b) to label all the equilibrium points as being either stable or unstable? *Answer:* See figure.

(d) If $x(0) = 400$ and $y(0) = 40$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 0$ and $y(75) \approx 310$.

(e) If $x(0) = 20$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 0$ and $y(75) \approx 310$.

(f) If $x(0) = 0$ and $y(0) = 200$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 0$ and $y(75) \approx 310$.

(g) If $x(0) = 450$ and $y(0) = 0$ estimate $x(75)$ and $y(75)$. *Answer:* $x(75) \approx 370$ and $y(75) \approx 0$.

(h) Describe the long term behavior of the competition. That is competitive exclusion, competitive coexistence, species x dominates, or species y dominates. *Answer:* The species y dominates.