Mathematics 172

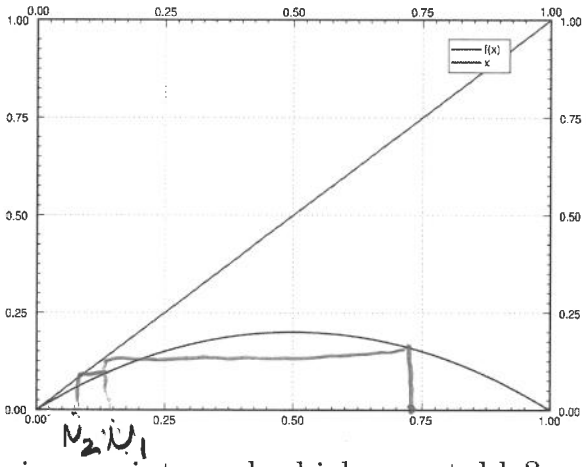
Quiz 19 **Name:** Key

You must show your work to get full credit.

1. If $N_0 = .7$ estimate

$N_1 \approx$ .25 $N_2 \approx$ .12 $N_{45} \approx$ 0

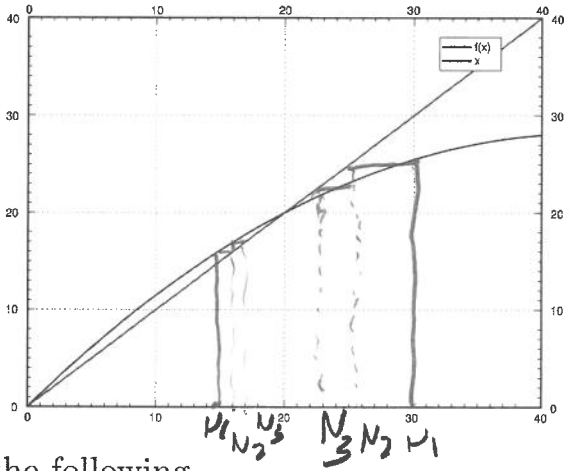
by drawing in the cobwebs.



What are the equilibrium points and which are stable?

Equilibrium points 0 Stable points 0

2. The graph here is for the discrete logistic system with per capita growth rate $r = .3$ and carrying capacity $K = 20$.



If $N_0 = 30$ estimate the following

$N_1 \approx$ 25 $N_2 \approx$ 23 $N_{32} \approx$ 30

If $N_0 = 15$ estimate the following

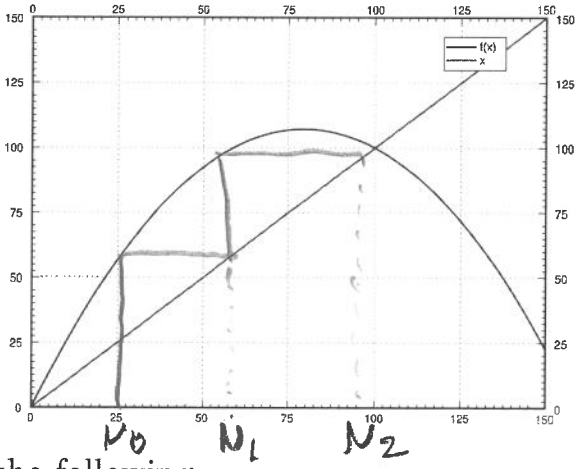
$N_1 \approx$ 16 $N_2 \approx$ 17 $N_{45} \approx$ 30

What are the equilibrium points and which are stable?

Equilibrium points 0, 30 Stable points 30

If $0 < N_0 < 40$ what can you say about N_{100}? Write a sentence explaining your answer. $N_{100} \approx 30$ as $N_0, N_1, N_2 \ldots$ will converge to the stable equilibrium point

3. The graph here is for the discrete logistic system with per capita growth rate $r = 1.7$ and carrying capacity $K = 100$.



If $N_0 = 25$ estimate the following

$N_1 \approx$ 56 $N_2 \approx$ 95 $N_{83} \approx$ 100

What are the equilibrium points and which are stable?

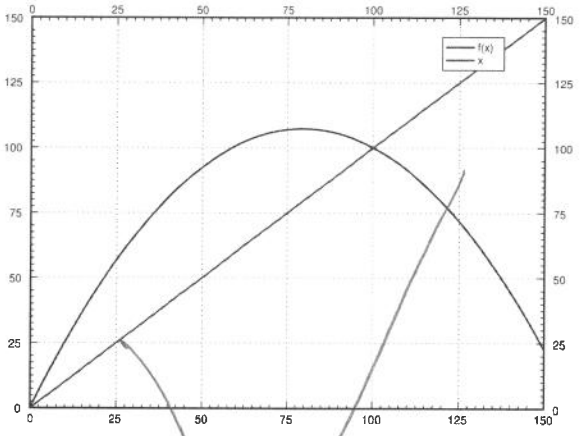
Equilibrium points 0, 100 Stable points 100

Write a sentence or two describing the long term behaviour this system.

~~Equilibrium points~~ ~~Stable points~~

4. The graph here is for the discrete logistic system with per capita growth rate $r = 1.7$ and carrying capacity $K = 100$.

Repeated my accident



If $N_0 = 25$ estimate the following

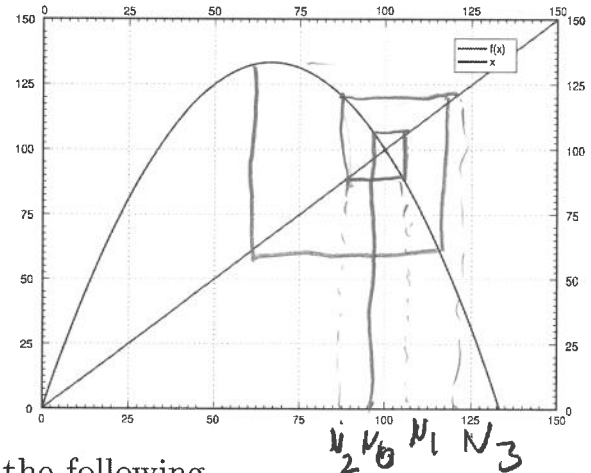
$N_1 \approx$ _____ $N_2 \approx$ _____ $N_{83} \approx$ _____

What are the equilibrium points and which are stable?

Equilibrium points _____ Stable points _____

Write a sentence or two describing the long term behaviour this system.

5. The graph here is for the discrete logistic system with per capita growth rate 2.5 and carrying capacity $K = 100$.



If $N_0 = 95$ estimate the following

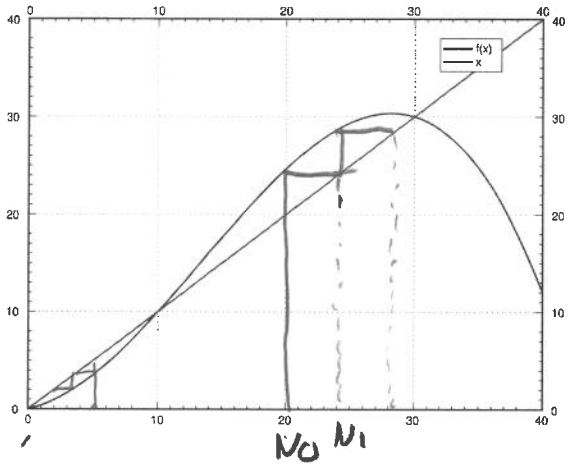
$N_1 \approx$ 110 $N_2 \approx$ 90 $N_3 \approx$ 12

What are the equilibrium points and which are stable?

Equilibrium points 0, 100 Stable points None

If $N_0 = 95$ can you make a reasonable estimate of N_{10}? If not why is this case different form the previous two examples? Write a few sentences explaining your answer. No. There are no stable equilibrium points, so $N_1, N_2, \ldots$ does not tend to any limit.

6. Here is the graph of a system $N_{t+1} = f(N_t)$



If $N_0 = 20$ estimate

$N_1 \approx$ 24 $N_2 \approx$ 28 $N_{32} \approx$ 30

If $N_0 = 5$ estimate

$N_1 \approx$ 9 $N_2 \approx$ 2.5 $N_{128} \approx$ 0

What are the equilibrium points and which are stable?

Equilibrium points 0, 10, 30 Stable points 0, 30 Write a few sentences explaining the long term behaviour of this system.

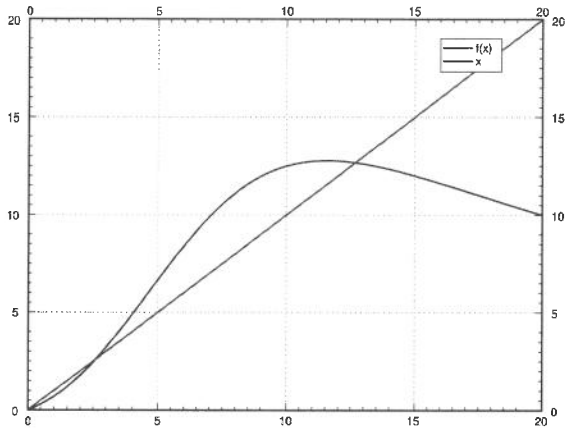
7. The following is the graph of N_{t+1} as a function of N_t for the system

If N_0 is between 0 and 10, then N_t goes to the stable point 0

If N_0 is between 10 and 40 it goes to the stable point 30.

So in long run, depending on the value of N_0 either the population dies off or stabilizes at $N=30$

$$N_{t+1} = \frac{.5N_t + .2N_t^2}{1 + .001N_t^3}$$



Use your calculator to find the equilibrium points.

The equilibrium points are 0, 2.587, 12.67

Use your calculator to find dy/dx at the equilibrium points. (List the points and the derivatives).

$\frac{dy}{dx} = .5$ at 0 $\quad \frac{dy}{dx} = 1.45$ at 2.58 $\quad \frac{dy}{dx} = -.18$ at 12.67

Which of the points are stable?i

Stable points are 0, 12.67

Write a few sentences explaining the long term behaviour of this system.

If No is between 0 and 2.58 the population dies off.

If No is between 2.58 and 20 it stabilizes at 12.67