Problem Set 3 Math 19

Pg. 71-72 ex. 1, 2, 4, p 6

1. $dx/dt = f(x)$

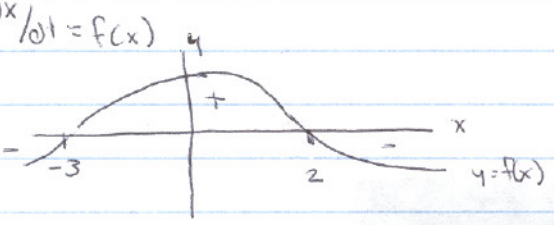
$\frac{dx}{dt} = f(x)$

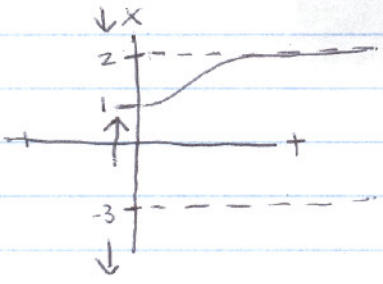
$y = f(x)$

$y = dx/dt$

$x(0) = 1$

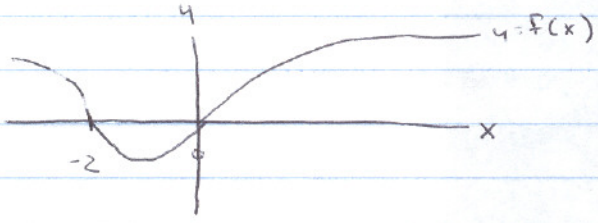
(a)

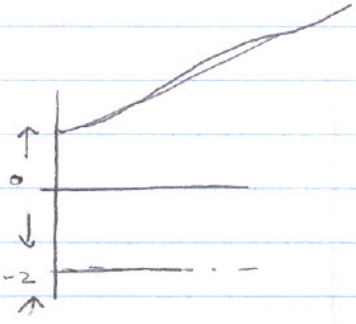




as ~~t~~ t gets large x(t) will ~~ge~~ increase until it reaches the equilibrium value at 2

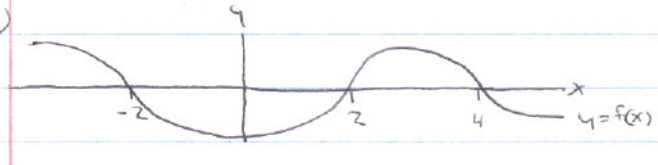
(b)

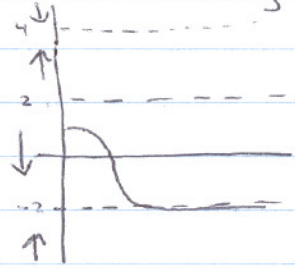




as t gets large x(t) will approach infinity

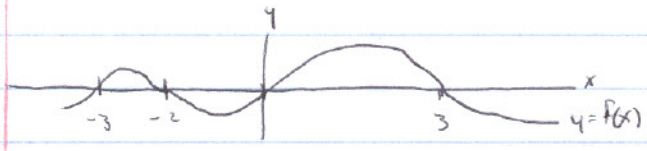
(c)

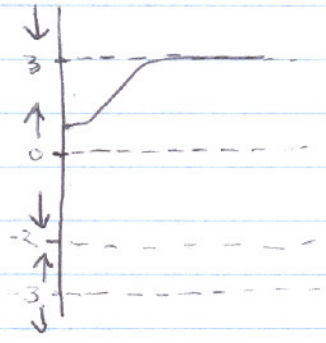




as t gets large x(t) will decrease until it reaches the equilibrium value of -2

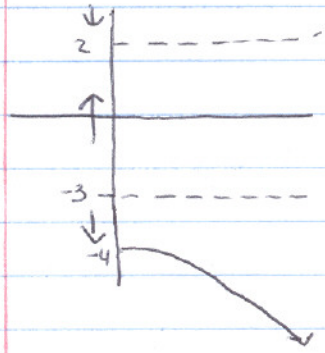
(d)





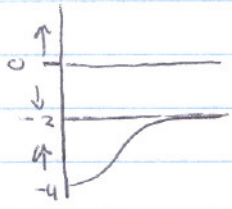
as t gets large x(t) will increase to the equilibrium value at 3.

2. (a) $x(0) = -4$



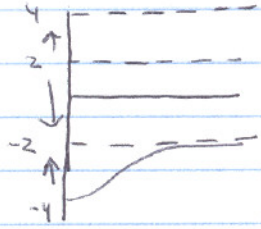
as t gets large $x(t)$ will decrease to $-\infty$

(b)



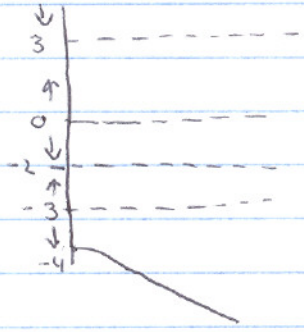
as t gets large $x(t)$ will increase to the equilibrium value of -2.

(c)



as t gets large $x(t)$ will increase to the equilibrium value of -2

(d)



as t gets larger $x(t)$ will approach $-\infty$
~~the equilibrium val~~

4 (a)

eq. pts	type
-3	unstable
2	stable

(b)

-2	stable
0	unstable

equilibriums are stable when both arrows on arrows on the phase line point to the equilibrium point & are unstable when 1 or both arrows point away.

4. (c)

eq point	type
-2	stable
2	unstable
4	stable

(d)

-3	unstable
-2	stable
0	unstable
3	stable

6 Notice the similarity between the given equation $dn/dt = \alpha n - v n^2$ and the logistic equation involving carrying capacity, that we talked about in class: $dP/dt = k(1 - \frac{P}{n})P$; n = carrying capacity this becomes: $dP/dt = kp - \frac{k}{n}p^2$

Now $\alpha = k$ and $v = \frac{k}{n}$

- at low populations $(1 - P/n) \approx 1$ $\therefore dP/dt \approx kp$

~~two population~~ if two (low) population counts at different times are available, k can be solved for by exponential growth.

- as ~~time~~ p increases it will tend towards the carrying capacity, n.

$\therefore$ since k is known (now), v can be calculated by $v = k/n$