WA 6

+ 44/44

1 (a) 8/8

(i) $(1.0\,L)(4.0\,mmol/L) = 4.0\,mmol$

(ii) $(.1\,L)(4.0\,mmol/L) = 0.4\,mmol$

(iii) $(0.9\,L)\cdot(4.0\,mmol/L) = 3.6\,mmol$

(iv) $(.1\,L)\cdot(8.0\,mmol/L) = 0.8\,mmol$

(v) $(3.6\,mmol) + (0.8\,mmol) = 4.4\,mmol$

(vi) $\dfrac{4.4\,mmol}{1.0\,L} = 4.4\,mmol/L$

+0.5 each

$$c_1 = c_0\left(1 - \frac{w}{v}\right) + \gamma\left(\frac{w}{v}\right) = (4.0)\left(1 - \frac{.1}{1.0}\right) + (8)\left(\frac{.1}{1}\right)$$
$$= (4.0)(.9) + .8$$
$$= 4.4\ mmol/L$$

+1

Yes, they agree!

(b)

(i) $(10.0\,L)(9.0\,mmol/L) = 90\,mmol$

(ii) $(0.2\,L)(9.0\,mmol/L) = 1.8\,mmol$

(iii) $90 - 1.8 = 88.2\,mmol$

(iv) $(0.2\,L)(1.0\,mmol/L) = 0.2\,mmol$

(v) $88.2\,mmol + 0.2\,mmol = 88.4\,mmol$

(vi) $\dfrac{88.4\,mmol}{10.0\,L} = 8.84\,\dfrac{mmol}{L}$.

+0.5 each

$$c_1 = (9)\left(1 - \frac{0.2}{10}\right) + (1)\left(\frac{0.2}{10}\right)$$
$$= (9)(0.98) + 0.02$$
$$= 8.84\ mmol/L$$

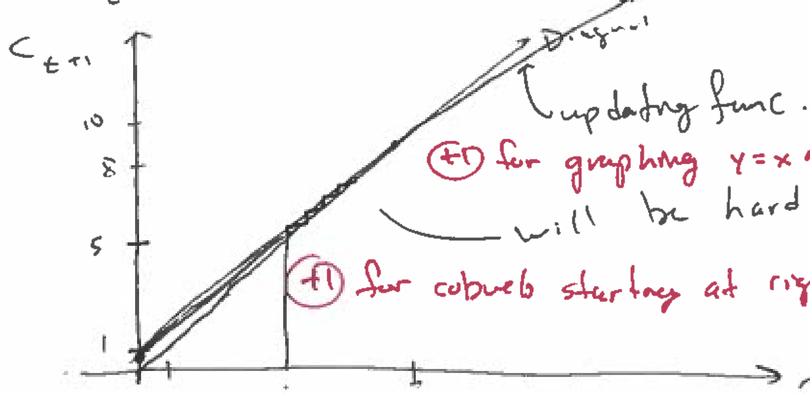
They agree!

+1

2 (a) 8/8

$$c_{t+1} = c_t\cdot\left(1 - \frac{.1}{1}\right) + 8(.1) = \boxed{c_t\cdot(0.9) + 0.8}$$

+2



+1 for graphing y=x and updating func,

will be hard to see.

+1 for cobweb starting at right place.

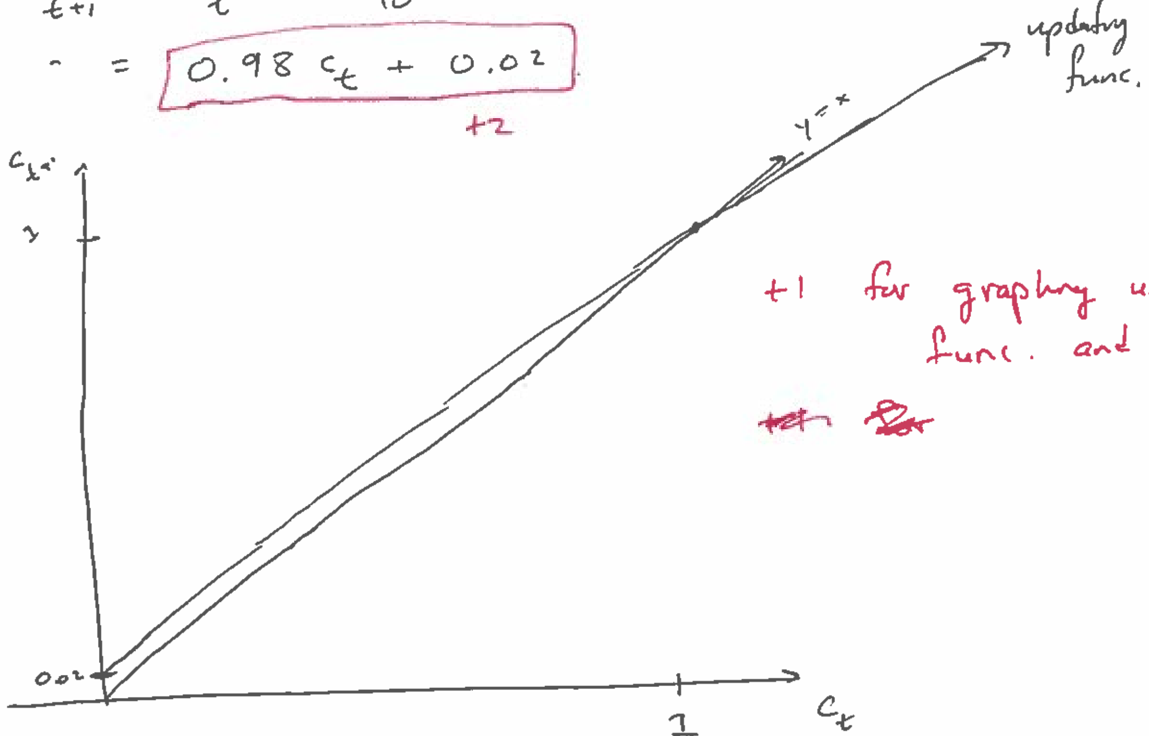
* The graphs probably won't look great; these updating func's are hard to distinguish from the diagonal.

(2b)

$$c_{t+1} = c_t\left(1 - \frac{0.2}{10}\right) + 1 \cdot \left(\frac{0.2}{10}\right)$$

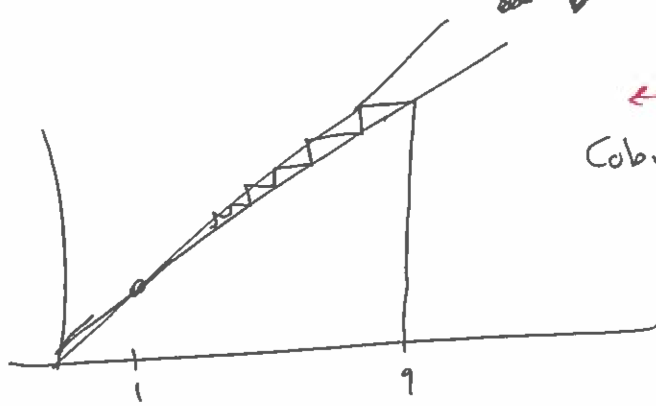
$$= \boxed{0.98\, c_t + 0.02}$$

+2



+1 for graphing updating func. and diagonal

* very hard to distinguish these lines,

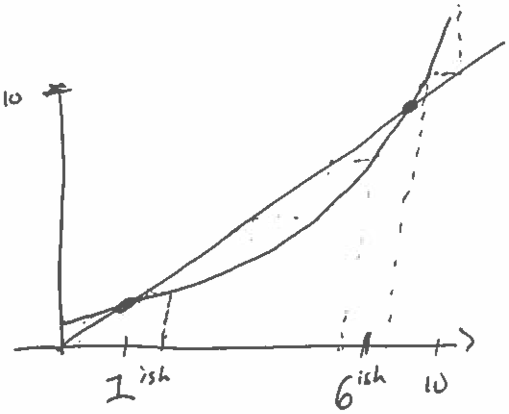


+1 for having a cobweb diagram like this.

Cobwebbing should look like this.

4 (a)

6/6



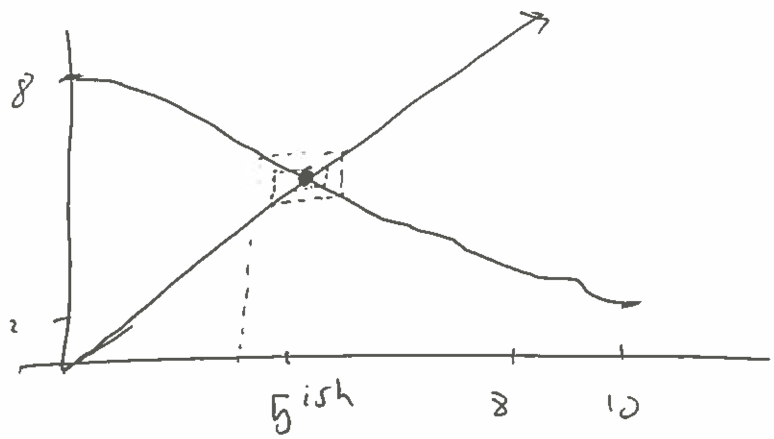
Equilibria are at 1 and 6

stable (+1) unstable (+1)

(+1) (+1)

check by cobwebbing.

(b)



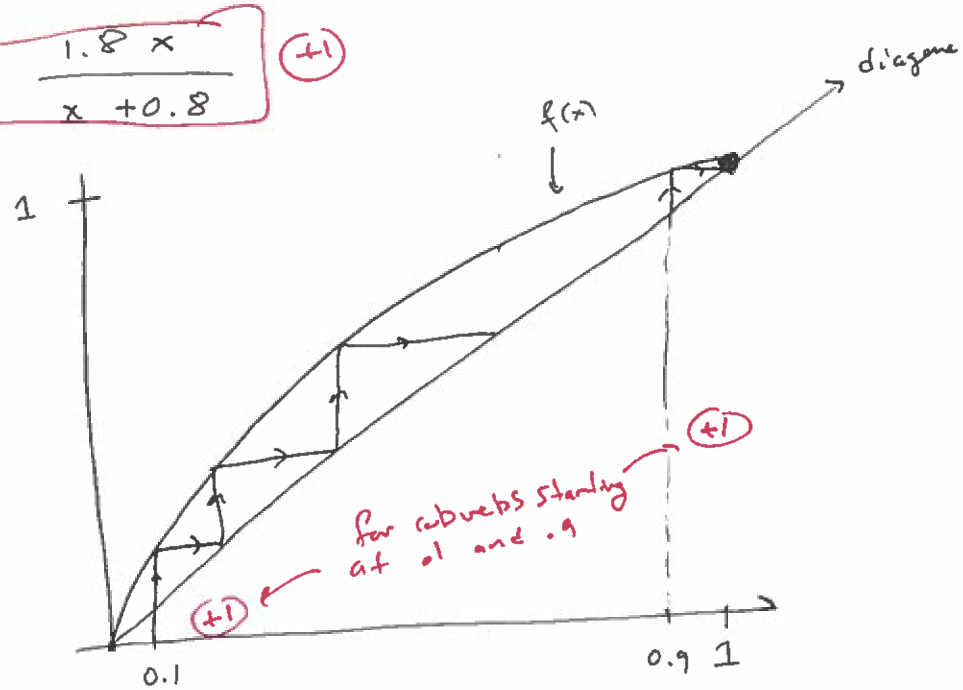
Equilibrium is $\boxed{x = 5.}$ (+1)

This is $\boxed{\text{stable}}$ (+1), because solutions near $x=5$ approach the equilibrium.

5 (a) $$P_{t+1} = \frac{1.8 P_t}{1.8 P_t + 0.8(1-P_t)} = \frac{1.8 P_t}{P_t + 0.8}$$

6/6

updating func:
$$\boxed{f(x) = \frac{1.8x}{x+0.8}}$$ (+1)

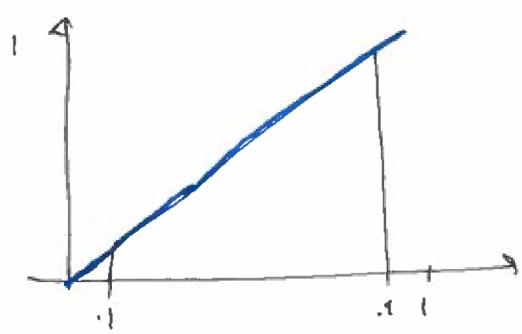


$x=0$ is unstable. (+1)

$x=1$ is stable. (+1)

(b) $$P_{t+1} = \frac{1.8 P_t}{1.8 P_t + 1.8(1-P_t)} = \frac{1.8 P_t}{1.8} = P_t.$$

When both populations have equal growth rates, the relative fraction is constant! $\boxed{f(x)=x}$ is the updating function. (+1)



* cobwebbing just stops at the point you start. *

(+1) * check for sensical answers; it's hard to give a right or wrong answer; be generous.

* every real number between 0 and 1 is an equilibrium, so it doesn't make a lot of sense to ask which ...

$\boxed{6}$. $\hat{V}_t = c \cdot V_t$.

12/12

(a) $\boxed{\hat{V}_t = 0.5 \cdot 30mV = 15\ mV}$ (+1)

Since $\hat{V}_t = 15mV \leq V_c$, the $\boxed{\text{heart will beat.}}$ (+1)

and $V_{t+1} = \hat{V}_t + u = 15 + 10\ mV = 25mV.$ (+1)

(b) $\hat{V}_t = 0.6 \cdot 30mV = 18mV.$ (+1)

Since $\underset{\hat{V}_t}{\underset{\shortparallel}{18mV}} \leq \underset{V_c}{\underset{\shortparallel}{20mV}}$, the heart $\boxed{\text{will beat.}}$ (+1)

and $V_{t+1} = \hat{V}_t + u = 18 + 10\ mV = 28mV.$ (+1)

(c) $\hat{V}_t = 0.7 \cdot 30\ mV = 21mV$ (+1)

since $21 \Rightarrow 20\ mV$, the heart $\boxed{\text{will not beat,}}$ (+1)

and $V_{t+1} = \hat{V}_t = 21mV.$ (+1)

(d) $\hat{V}_t = 0.8 \times 30 = 24\ mV$ (+1)

Since $24\ mV > 20\ mV$, the heart $\boxed{\text{will not beat.}}$ (+1)

and $V_{t+1} = \hat{V}_t = 24\ mV.$ (+1)

EC

(a)

$$h_{t+1} = h_t - 3z_t$$
$$z_{t+1} = 2z_t$$

6/6

$$p_t \stackrel{df}{=} \frac{h_t}{h_t + z_t}$$

$$p_{t+1} = \frac{h_{t+1}}{h_{t+1} + z_{t+1}} = \frac{h_t - 3z_t}{h_t - 3z_t + 2z_t}$$

$$= \frac{h_t - 3z_t}{h_t - z_t}$$

$$= \frac{\frac{h_t}{h_t+z_t} - 3\frac{z_t}{h_t+z_t}}{\frac{h_t}{h_t+z_t} - \frac{z_t}{h_t+z_t}}$$

$$= \frac{p_t - 3(1-p_t)}{p_t - (1-p_t)}$$

$$\boxed{p_{t+1} = \frac{4p_t - 3}{2p_t - 1}}$$

+2

(b) $f(x) = \frac{4x-3}{2x-1}$

$f(x) = x$:

$$\frac{4x-3}{2x-1} = x$$
$$4x - 3 = (2x-1)x$$
$$4x - 3 = 2x^2 - x$$
$$0 = 2x^2 - 5x + 3$$

+1 $x = 1$ and +1 $x = 1.5$.

Makes sense; says there are no zombies

Doesn't make sense; can't have 150% of pop. being human.

(c) The model won't make sense once 50% or more of the total population become zombies, because at the next step there are no humans left. (+1)

(d) You can see in the cobweb diagram that solutions that tend to a value of $p_t < 0.5$ will jump to a number bigger than 1, which means the model breaks down.

(+1)