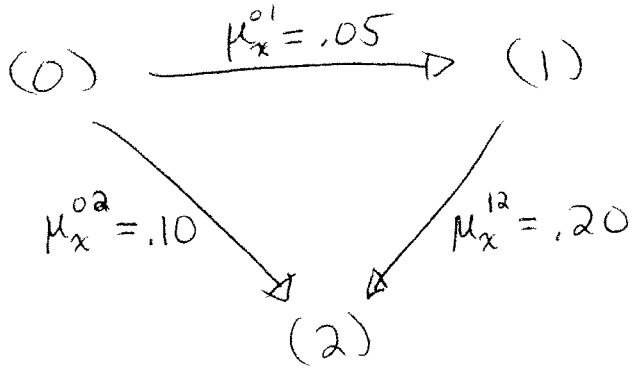
1) (See Video Solution)



(a) ${}_5p_x^{00} = e^{-.75}$

(b) ${}_5p_x^{01} = e^{-.75} - e^{-1}$

(c) ${}_5p_x^{02} = 1 - 2e^{-.75} + e^{-1}$

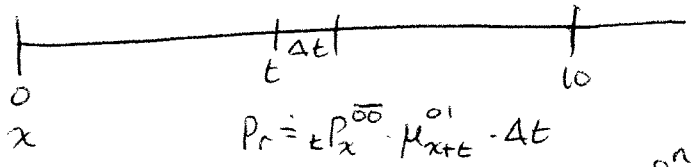
2) (0) $\xrightarrow{\mu^{01}_{x+t} = .02t}$ (1)

(a) ${}_{10}p_x^{00} = {}_{10}p_x^{\overline{00}} = e^{-\int_0^{10} \mu^{0\hat{t}}_{x+t}\, dt} = e^{-\int_0^{10} .02t\, dt}$

$= e^{-.01t^2\Big|_0^{10}} = e^{-1}$

(b) ${}_{10}p_x^{01} = 1 - {}_{10}p_x^{00} = 1 - e^{-1}$ (easy way)

(hard way):



$P_r = {}_tp_x^{\overline{00}} \cdot \mu^{01}_{x+t} \cdot \Delta t$

$\therefore {}_{10}p_x^{01} = \int_0^{10} {}_tp_x^{\overline{00}}\, \mu^{01}_{x+t}\, dt$ $\quad {}_np_x^{\overline{00}} = e^{-\int_0^n .02t\, dt} = e^{-.01n^2}$

$\Rightarrow {}_tp_x^{\overline{00}} = e^{-.01t^2}$

$\therefore {}_{10}p_x^{01} = \int_0^{10} e^{-.01t^2}(.02t)\, dt$

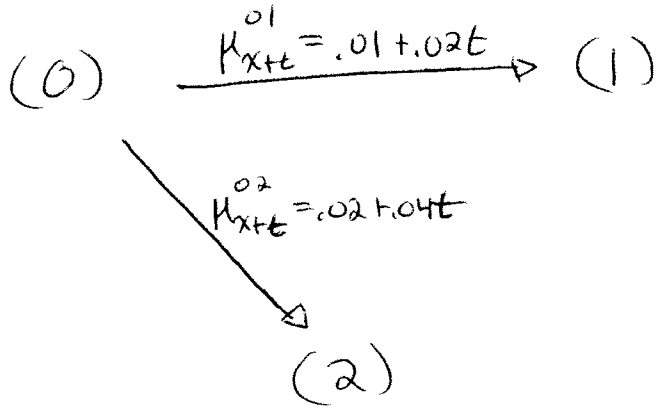
$u = .01t^2$

$du = .02t\, dt$

t	u
0	0
10	1

$= \int_0^1 e^{-u}\, du = e^{-u}\Big|_1^0 = 1 - e^{-1}$ (as above)

3) (See Video Solution)



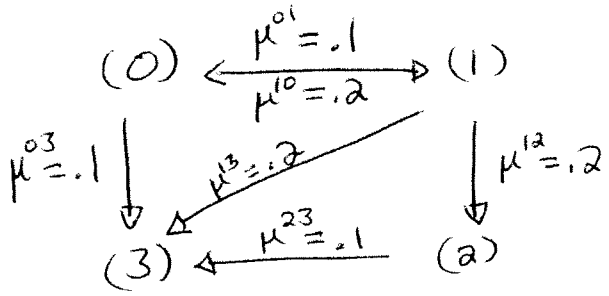
(a) ${}_{10}p_x^{00} = e^{-3.3}$

(b) ${}_{1}p_x^{10} = 0$

(c) ${}_{K}p_x^{11} = 1$

(d) ${}_{10}p_x^{02} = \frac{2}{3}\left(1 - e^{-3.3}\right)$

4)



(a) ${}_0p_x^{01} = 0$ since given (x) is in state 0 at time 0
it's impossible to be in state 1 at time 0

(b) ${}_5p_x^{\overline{11}} = e^{-\int_0^5 \mu_{x+t}^{1\hat{}}\, dt}$ $\quad \mu_{x+t}^{1\hat{}} = \mu^{10} + \mu^{12} + \mu^{13} = .2+.2+.2 = .6$

$\Rightarrow {}_5p_x^{\overline{11}} = e^{-.6(5)} = e^{-3}$

(c) ${}_{10}p_x^{22} = {}_{10}p_x^{\overline{22}}$ $\quad \mu_{x+t}^{2\hat{}} = \mu^{23} = .1$

$\Rightarrow {}_{10}p_x^{22} = {}_{10}p_x^{\overline{22}} = e^{-.1(10)} = e^{-1}$

(d) ${}_t\dot{p}_x^{23} = \overbrace{{}_tp_x^{20}\cdot\mu_{x+t}^{03} + {}_tp_x^{21}\cdot\mu_{x+t}^{13} + {}_tp_x^{22}\cdot\mu_{x+t}^{23}}^{=\text{rate in}} - \overbrace{{}_tp_x^{23}\cdot\mu_{x+t}^{3\hat{}}}^{=\text{rate out}}$

($\underbrace{{}_tp_x}_{=0}$, $\underbrace{{}_tp_x^{21}}_{=0}$, $\underbrace{\mu_{x+t}^{3\hat{}}}_{=0}$)

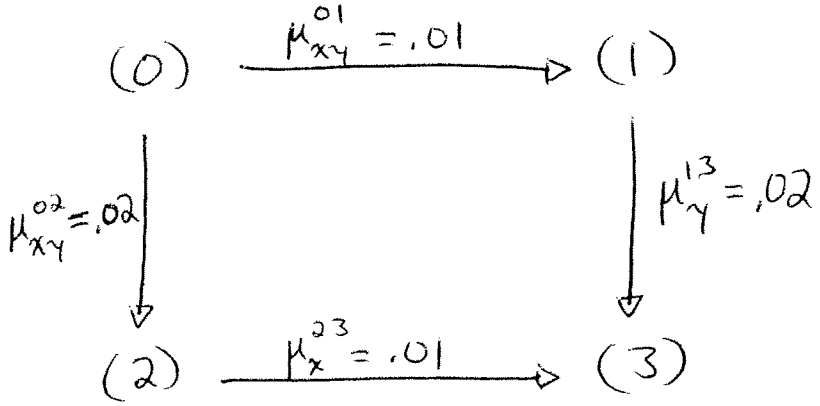
$\therefore {}_t\dot{p}_x^{23} = {}_tp_x^{22}\cdot\mu_{x+t}^{23}$ $\quad \mu_{x+t}^{23} = .1$, ${}_tp_x^{22} \overset{\text{see part (c)}}{=} e^{-.1t}$

$\Rightarrow {}_t\dot{p}_x^{23} = .1e^{-.1t}$

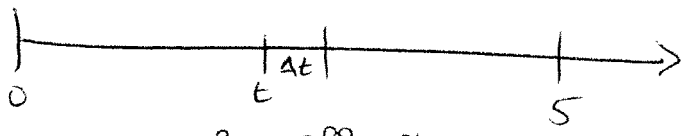
(e) ${}_t\dot{p}_x^{10} = \overbrace{{}_tp_x^{11}\cdot\underbrace{\mu_{x+t}^{10}}_{=.2} + {}_tp_x^{12}\cdot\underbrace{\mu_{x+t}^{20}}_{=0} + {}_tp_x^{13}\cdot\underbrace{\mu_{x+t}^{30}}_{=0}}^{=\text{rate in}} - \overbrace{{}_tp_x^{10}\cdot\underbrace{\mu_{x+t}^{0\hat{}}}_{=.1+.1=.2}}^{=\text{rate out}}$

$\therefore {}_t\dot{p}_x^{10} = .2\,{}_tp_x^{11} - .2\,{}_tp_x^{10}$

5)



We seek ${}_5P^{01}$:



$P_r = {}_tP^{00} \cdot \mu^{01} \cdot \Delta t \cdot {}_{(5-t)}P^{11}$

$$\therefore {}_5P^{01} = \int_0^5 {}_tP^{00} \cdot \mu^{01} \cdot {}_{(5-t)}P^{11}\, dt$$

$${}_nP^{00} = {}_nP^{\overline{00}} = e^{-\int_0^n \mu^{0\tau} d\tau} = e^{-\int_0^n (.01+.02)\, d\tau} = e^{-.03n}$$

$${}_nP^{11} = {}_nP^{\overline{11}} = e^{-\int_0^n \mu^{1\tau} d\tau} = e^{-.02n}$$

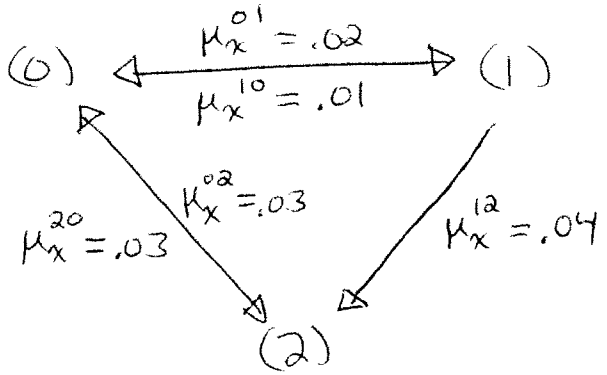
$$\therefore {}_5P^{01} = \int_0^5 e^{-.03t} (.01)\, e^{-.02(5-t)}\, dt$$

$$= .01 e^{-.1} \int_0^5 e^{-.01t}\, dt$$

$$= e^{-.1} \cdot e^{-.01t} \Big|_5^0 = e^{-.1}(1 - e^{-.05})$$

$$= e^{-.1} - e^{-.15}$$

6) (See Video Solution)



(a) $.5\dot{P}_x^{00} = -.0482$

(b) $.6P_x^{00} \approx .97018$