#1

$$-\lambda(v_t-\bar{v})\Delta t + \eta\sqrt{v_t}\,\Delta Z(t_n)$$

$$+\frac{1}{2}\cdot\eta\cdot\cancel{\sqrt{v_t}}\cdot\eta\cdot\frac{1}{2\cancel{\sqrt{v_t}}}\cdot(\Delta Z^2-\Delta t)$$

$$= -\lambda(v_t-\bar{v})\Delta t + \eta\sqrt{v_t}\,\Delta Z$$

$$+\frac{1}{4}\eta^2\cdot(\Delta Z^2-\Delta t)$$

$$= -\lambda(v_t-\bar{v})\Delta t + \eta\sqrt{v_t}\cdot\sqrt{\Delta t}\cdot\phi_t$$

$$+\frac{1}{4}\eta^2\cdot(\Delta t\cdot\phi_t^2-\Delta t) + v_t$$

$$= \frac{\eta^2}{4}\Delta t\cdot\phi_t^2 + \eta\sqrt{v_t}\cdot\sqrt{\Delta t}\cdot\phi_t - \lambda(v_t-\bar{v})\Delta t - \frac{1}{4}\eta^2\Delta t + v_t$$

$\delta = 0$

$B_0 = 2.323379$ $\quad -0.71664 + 0.016 \times 100 + B_0 = 0$

$V_0 = 0.71664$

$\delta_0 = 0.016067$

$B_0 \cdot e^{0.03} +$

$\Pi_N = -V + \delta_{N-1} \cdot S_N + B_{N-1} e^{rt}$

$P\&L = \dfrac{e^{-rT} \cdot \Pi_N}{V(S_0, 0)} = \dfrac{\quad}{0.71664}$ $\quad \Pi_N = -V + \delta_{N-1} \cdot S_N + B_N$

$$\frac{e^{-rT} \cdot \left(0 + 0 + B_0 \cdot \cancel{e^{rT}}\right)}{0.71664}$$

$$\frac{0.156197 - 0}{84.2918 - 70.484957} \cdot (77.234174 - 70.484957)$$

$$\frac{B_0}{0.71664}$$

$= 0.07636$

$$\frac{e^{-rT} \cdot \left(0 + 0.57414\cdot 77.234 + B_0 \cdot e^{rT}\right)}{0.71664}$$

$\boxed{-0.140201}$

~~0.156197~~ -

$\log(J) = y \qquad y \le 1$

$\log J \le 1$

$f\left(\log(J)\right) = p_u \mu_u \exp(-\mu_u \log(J))$
$\qquad + (1-p_u)\cdot \mu_d \exp(\mu_d \log(J))$

$y = \log J.$

$J = e^y \qquad f(J) = p_u \mu_u e^{-\mu_u \cdot \log J}$

$k = \log x$

$\qquad = \frac{p_u \mu_u}{e^{\mu_u \log J}} \cdot 1_{J \le 1}$

$f(k) = k^2$

$f(x) = ?$

$\qquad = \frac{p_u \mu_u}{e^{\mu_u} \cdot J} \cdot 1_{J \le 1}$

$\qquad + (1-p_u) \cdot \mu_d \cdot J \cdot e^{\mu_d} \cdot 1_{J \ge 1}$

$\int_0^\infty J f(J)$

$\int_0 \frac{p_u \mu_u}{e^{\mu_u} \cdot \cancel{J}} \cdot \cancel{J} + \int_1^\infty (1-p_u) \cdot \mu_d J^2 \cdot e^{\mu_d}$

$\frac{p_u \mu_u}{e^{\mu_u}} + \frac{1}{3} J^3 \cdot (1-p_u) \cdot \mu_d \cdot e^{\mu_d}$

$e^{-d} = 0$

$\_\_\_\_\_\_ + \frac{p_u - 1}{u_d}$

$$f(y) = p_u \mu_u e^{-\mu_u y} 1_{y \geq 0} + (1-p_u)\mu_d \exp(\mu_d y) 1_{y<0}$$

$$f(J) = p_u \mu_u e^{-\mu_u} \quad 1_{J \geq 1} + (1-p_u)\mu_d \exp(\mu_d \quad) 1_{J<1}$$

$y = \log J$

$J = e^y$

$$\int_0^{\infty} p_u \mu_u y e^{-\mu_u y} \, dy \qquad \frac{dk}{dy} = \mu_u$$

$$p_u \cdot \int_0^{\infty} k e^{-k} \, dk = p_u \left[-e^{-x}(x+1) \right] \Big|_0^{\infty}$$

$$p_u [0 + 1] = p_u \mu_u$$

$(1-p_u)$

$$\int_{-\infty}^{0} \mu_d y \exp(\mu_d y) \, dy$$

$E[J-1]$

$E(J) = E(e^y)$

$= \int_{-\infty}^{\infty} \Big(e^y p_u \mu_u e^{-\mu_u y} \cdot 1_{y \geq 0}$

$+ e^y (1-p_u) \mu_d e^{\mu_d y} 1_{y < 0} \Big) dy$

$= \int_0^{\infty} p_u \mu_u e^{(1-\mu_u) y} \cancel{dy}$

$+ \int_{-\infty}^{0} e^y (1-p_u) \mu_d e^{\mu_d y}$

$= p_u \mu_u \cdot \left[\frac{1}{1-\mu_u} e^{(1-\mu_u) y} \right] \Big|_0^{\infty}$

as $\mu_u > 1$, $\lim_{y \to \infty} e^{(1-\mu_u) y} = 0$

$= p_u \mu_u \cdot \left[0 - \frac{1}{1-\mu_u} \cdot 1 \right]$

$= \frac{p_u \cdot \mu_u}{\mu_u - 1}$

$\int_{-\infty}^{0} (1-p_u) \mu_d e^{(\mu_d + 1) y}$

$= (1-p_u) \mu_d \left[\frac{1}{\mu_d + 1} e^{(\mu_d + 1) y} \right]_{-\infty}^{0}$

$$= (1-p_u)\, u_d \cdot \left(\frac{1}{u_d+1} [1-0] \right)$$

$$\frac{(1-p_u)\cdot u_d}{u_d+1}$$

$$E(y) = p_u \left[-\frac{(u_u y+1) e^{-u_u y}}{u_u} \right]_0^{\infty} + (1-p_u) \left[\frac{(u_d y-1) e^{u_d y}}{u_d} \right]_{-\infty}^{0}$$

$$p_u \left[\frac{-1}{u_u} [0-1] \right] + (1-p_u) \left[\frac{1}{u_d} (-1-0) \right]$$

$$E(y) = \frac{p_u}{u_u} + \frac{p_u - 1}{u_d}$$

$$E(y^2) = p_u \left[\frac{-(u_u^2 x^2 + 2u_u x + 2) e^{-u_u x}}{u_u^2} \right]_0^{\infty}$$

$$+ (1-p_u) \left[\frac{(u_d x^2 + 2u_d x + 2)\, e^{u_d x}}{u_d^2} \right]_{-\infty}^{0}$$

$$= p_u \left[\frac{-1}{u_u^2} [0-2] \right] + (1-p_u) \left[\frac{1}{u_d^2} [2-0] \right]$$

$$= \frac{2p_u}{u_u^2} + \frac{2(1-p_u)}{u_d^2}$$