(25)

$$P = A e^{Mx}$$

$$\ln P = \ln A + Mx.$$

$$\ln P = y \,,\quad \ln A = B.$$

$$M \sum_{i=1}^{n} x_i^2 + B \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} x_i y_i$$

$$M \sum_{i=1}^{n} + B \times n = \sum_{i=1}^{n} y_i$$

x_i	1	2	3	4
$y = \ln P_i$	1,04	2,40	2,83	3,30

$$\sum_{i=1}^{4} x_i^2 = 30 \,,\quad \sum_{i=1}^{4} x_i = 10.$$

$$\sum_{i=1}^{4} x_i y_i = 28,43 \,,\quad \sum_{i=1}^{4} y_i = 10,47.$$

$$30M + 10B = 28,43.$$

$$10M + 4B = 10,47$$

$$M = 0,45.$$

$$B = 1,49.$$

$$\ln A = B \Rightarrow A = e^{B} = 4,43.$$

$$P(x) = A e^{Mx}$$

$$= 4,43\, e^{0,45x}.$$

(20) مثال: معادلة تفاضلية من الرتبة الأولى

$$-dN(t) \propto N \cdot t\, dt.$$

$$\frac{-dNt}{dt} = -\frac{N}{\tau}. \Rightarrow N(t) = N_0 e^{-\frac{t}{\tau}}.$$

مثال: متسلسلة منتهية

$$N(t+\Delta t) = Nt + \frac{dN(t)}{\Delta t} + \frac{1}{2}(\Delta t)^2 \frac{d^2N}{dt^2} + \cdots$$

$$\frac{dN(t)}{\Delta t} = \lim_{\Delta t \to 0} \frac{N(t+\Delta t) - N(t)}{\Delta t}.$$

$$\frac{dN(t)}{dt} \sim \frac{N(t+\Delta t) - N(t)}{\Delta t}.$$

$N(t)$. $T = N \cdot \Delta t$ .. $i = 0, 1, 2, 3 \ldots i$

$$t = t_i = i \cdot \Delta t.$$

$$N(t+\Delta t) = N_i + \frac{dN}{dt} \Delta t.$$

$$N(t-\Delta t) = N(t) - \Delta t \cdot \frac{N(t)}{\tau}.$$

$$N(i+1) = N(i) + \Delta t \frac{N_{i+1}}{\tau}.$$

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(25) مثال: معادلة تفاضلية من الرتبة الثانية البسيط

$$\frac{d\theta}{dt} = \omega. \Rightarrow \omega = \frac{-g}{\ell}\theta.$$

من تعريف المشتق:

$$\frac{df}{dt} = \frac{f(t+\Delta t) - f(t)}{\Delta t}. \quad \Delta t \to 0.$$

نفرض أن المتغيرات صغيرة

$$\theta(t+\Delta t) \simeq \theta(t) + \omega(t)\Delta t.$$

$$\omega(t+\Delta t) \simeq \omega(t) + \frac{g}{\ell}\theta(t)\Delta t.$$

$$t = t_i = i\Delta t .$$

$$\theta(t) = \theta(i) \quad \omega(t) = \omega(i) .$$

$$T = N . \Delta t .$$

$$\omega(i+1) = \omega(i) - \frac{g}{\ell} \theta(i) \Delta t .$$

$$\theta(i+1) = \theta(i) + \omega(i) \Delta t .$$

حیث یمکن ان نحلل المعادلات التفاضلیة الرئیسیة

$$\omega(i) = \omega(i-1) - \frac{g}{\ell} \theta(i-1) \Delta t .$$

$$\theta(i) = \theta(i-1) + \omega(i-1) \Delta t .$$

$$\hat{\omega}(i) = \hat{\omega}(i-1) , \quad \hat{\theta}(i) = \hat{\theta}(i-1)$$

$$\hat{\omega}(i+1) = \hat{\omega}(i) - \frac{g}{\ell} \hat{\theta}(i) \Delta t .$$

$$\hat{\theta}(i+1) = \hat{\theta}(i) + \hat{\omega}(i) \Delta t .$$