a) (i) $\log(a) - \log(b) = \log(a/b)$

(ii) $\log(a/b) = \log\left(1 + \frac{(a-b)}{b}\right)$

(iii) $\log(1+x) \approx x$ for small x

$$\begin{aligned}
\Delta \log(y_i) &= \log(y_i) - \log(y_{i-1}) && \text{(i)} \\
&= \log\left(\frac{y_i}{y_{i-1}}\right) && \text{(ii)} \\
&= \log\left(1 + \frac{y_i - y_{i-1}}{y_{i-1}}\right) && \text{(iii)} \\
&= \log\left(1 + \frac{\Delta y_i}{y_{i-1}}\right) \\
&\approx \frac{\Delta y_i}{y_{i-1}}
\end{aligned}$$

b) $b_2 = -0.347$ std $= 0.213$ $t = -1.630$ $p = 0.107$

c) $b_3 = 0.048$ std $= 0.086$ $t = 0.563$ $p = 0.575$

b) relationship not quadratic

c) relationship might be stable over pre and post 1980 period.