Part-I

$$(1)\ u(x)=\begin{cases}-2x^2+\dfrac{4}{3}, & 0\le x\le\dfrac{1}{3}\\ -\dfrac{x^2}{2}-x+\dfrac{3}{2}, & \dfrac{1}{3}<x\le 1\end{cases}$$

$$(2)\ F=\frac{1}{2}\begin{bmatrix} hf\left(\dfrac{h}{2}\right)\\ hf\left(\dfrac{h}{2}\right)+Hf\left(\dfrac{2h+H}{2}\right)\\ Hf\left(\dfrac{2h+H}{2}\right)\end{bmatrix}$$

$$(3)\ h=H=\frac{1}{2}\rightarrow\begin{bmatrix}U_0\\U_1\end{bmatrix}=\begin{bmatrix}13/8\\9/8\end{bmatrix},h=\frac{1}{3}H=\frac{2}{3}\rightarrow\begin{bmatrix}U_0\\U_1\end{bmatrix}=\begin{bmatrix}4/3\\10/9\end{bmatrix}$$

Part-II

[K,F,Kb,Fb,U]=hw10($\underbrace{[1/2\ 1/2]}_{\text{sub-intervals}}$, $\underbrace{3}_{\text{nodes at boundary}}$)