1. 如圖1所示之梁元素。

   (1)如圖1a所示，試推導梁元素之局部座標勁度矩陣k'；$q = k' d$, 式中$q^T = [q_1, q_2, q_3, q_4, q_5, q_6]$, $d^T = [d_1, d_2, d_3, d_4, d_5, d_6]$。(10%)

   (2)試推導位移轉換矩陣T；$d = TD$, 式中$D^T = [D_1, D_2, D_3, D_4, D_5, D_6]$。(10%)

   (3)如圖1b所示，試推導梁元素之整體座標勁度矩陣k；$Q = k D$, 式中$Q^T = [Q_1, Q_2, Q_3, Q_4, Q_5, Q_6]$, $D^T = [D_1, D_2, D_3, D_4, D_5, D_6]$。(10%)
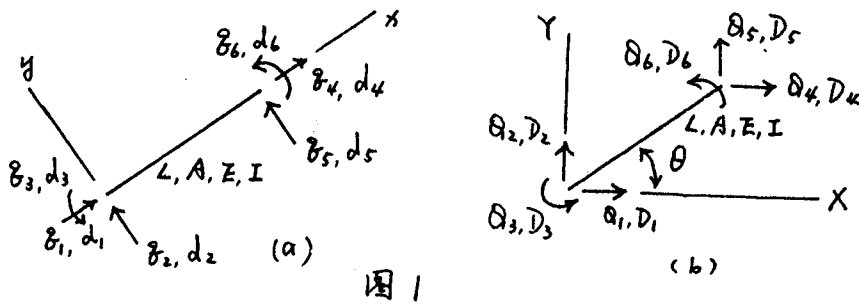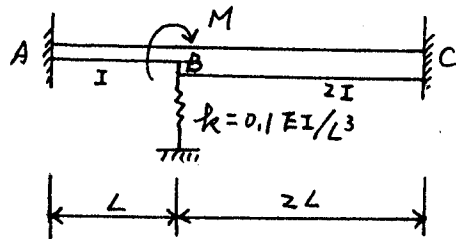

   圖 1

2. 如圖所示之梁，假設不考慮梁之軸力效應，

   (1)試應用前題推導之勁度矩陣，以矩陣勁度法(matrix stiffness method)解之。(15%)

   (2)試以傾角變位法(slope deflection method)解之。(15%)

   (3)試繪此梁之剪力圖、彎矩圖與彈性變形曲線。(10%)

3. 如圖所示之複合結構，假設$I/A_{beam} = 40 \ cm^2$, $A_{truss} = A_{beam}/4$, 如不考慮梁之軸力效應，

   (1)試以最小功法(method of least work)解之，並求桁架各桿內力與支承反力。(20%)

   (2)試繪此梁之剪力圖、彎矩圖與彈性變形曲線。(10%)