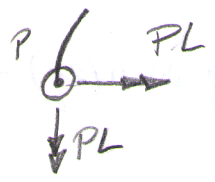


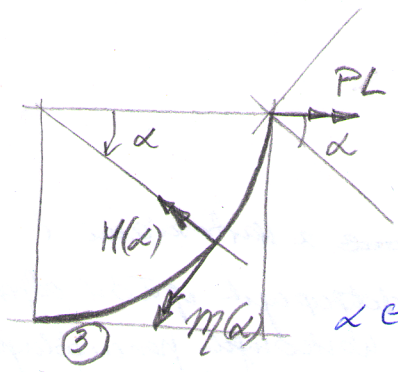
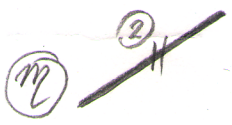
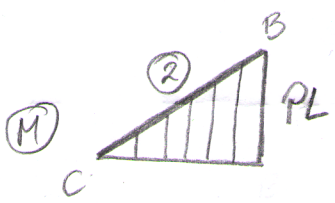
$EJ = GJs$

$W_A - ?$

Reakcje u podpore:

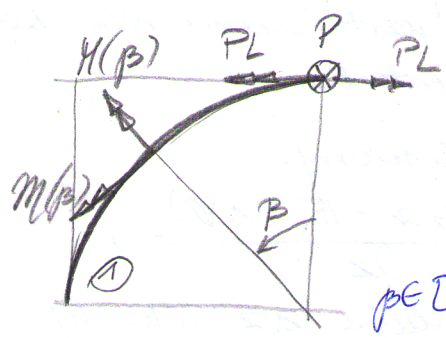


elementy od nit zsumptujemy (dla uzyskania  $W_A$ ):



$$\left. \begin{aligned} H(\alpha) - PL \cos \alpha &= 0 \Rightarrow H(\alpha) = PL \cos \alpha \\ M(\alpha) - PL \sin \alpha &= 0 \Rightarrow M(\alpha) = PL \sin \alpha \end{aligned} \right\} \textcircled{3}$$

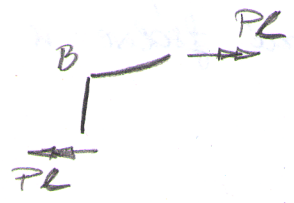
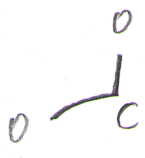
$\alpha \in [0; \frac{\pi}{2}]$



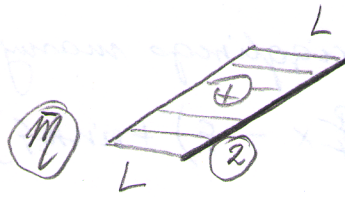
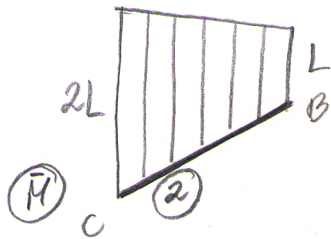
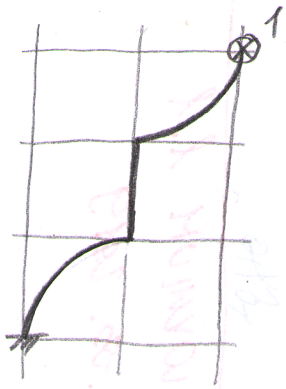
$$\left. \begin{aligned} H(\beta) + PL \sin \beta &= 0 \Rightarrow H(\beta) = -PL \sin \beta \\ M(\beta) - PL(1 - \cos \beta) &= 0 \Rightarrow M(\beta) = PL(1 - \cos \beta) \end{aligned} \right\} \textcircled{1}$$

$\beta \in [0; \frac{\pi}{2}]$

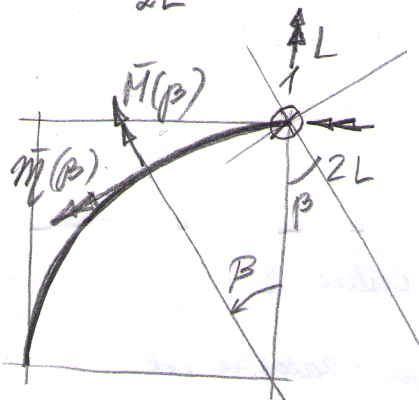
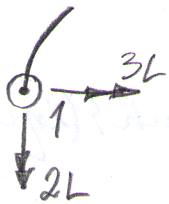
Sprawdzania:



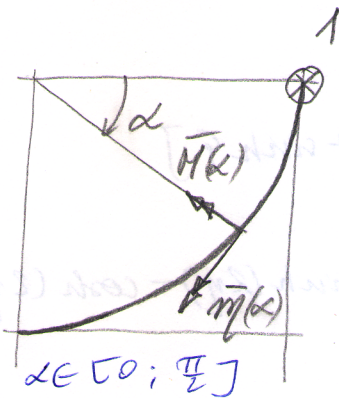
Elementy od obciążenia jednostkowego przystrojonego i niepełna kulowego (2)  
 przemienienia:



Reakcje u podpory:



$\beta \in [0; \frac{\pi}{2}]$



$$\bar{M}(\alpha) + 1 \cdot L \sin \alpha = 0$$

$$\bar{M}(\alpha) = -L \sin \alpha$$

$$\bar{m}(\alpha) + 1 \cdot L (1 - \cos \alpha) = 0$$

$$\bar{m}(\alpha) = -L (1 - \cos \alpha)$$

$$\bar{M}(\beta) + L \cos \beta + 2L \sin \beta + 1 \cdot L \sin \beta = 0$$

$$\bar{M}(\beta) = -L \cos \beta - 3L \sin \beta$$

$$\bar{m}(\beta) - L \sin \beta + 2L \cos \beta - 1 \cdot L (1 - \cos \beta) = 0$$

$$\bar{m}(\beta) = L \sin \beta - 3L \cos \beta + L$$

Znajdujemy przemienienia  $W_A$ :

$$W_A = \frac{1}{EJ} \left[ \frac{1}{2} L \cdot L \cdot \left(-\frac{2}{3} PL\right) + \frac{1}{2} L \cdot 2L \cdot \left(-\frac{1}{3} PL\right) + \frac{1}{EJ} \int_0^{\frac{\pi}{2}} PL \cos \alpha (-L \sin \alpha) L d\alpha \right. \\
+ \frac{1}{GJ_s} [0] + \frac{1}{GJ_s} \int_0^{\frac{\pi}{2}} PL \sin \alpha (-L) (1 - \cos \alpha) L d\alpha + \frac{1}{EJ} \int_0^{\frac{\pi}{2}} -L \sin \beta (-L \cos \beta - 3L \sin \beta) L d\beta \\
+ \frac{1}{GJ_s} \int_0^{\frac{\pi}{2}} PL (1 - \cos \beta) (L \sin \beta - 3L \cos \beta + L) L d\beta = \frac{1}{EJ} \left[ -\frac{2}{3} PL^3 - \frac{1}{2} PL^3 - \frac{1}{2} PL^3 \right. \\
\left. + \frac{3}{4} \pi PL^3 + \frac{1}{2} PL^3 - \frac{7}{2} PL^3 + \frac{5}{4} \pi PL^3 \right] = \frac{PL^3}{EJ} \left[ -\frac{28}{6} + 2\pi \right] \approx 1,617 \frac{PL^3}{EJ}$$