

-----1	1
$\frac{p}{2} \cdot r \cdot (1 - \cos(\theta 1)) - h \cdot r \cdot \sin(\theta 1) \rightarrow m1$	$\left(-h \cdot \sin(\theta 1) - \frac{p \cdot (\cos(\theta 1) - 1)}{2} \right) \cdot r$
$\frac{p}{2} \cdot \frac{r}{2} \cdot (1 - \cos(\theta 2)) - h \cdot \frac{r}{2} \cdot \sin(\theta 2) \rightarrow m2$	$\left(\frac{-h \cdot \sin(\theta 2)}{2} - \frac{p \cdot (\cos(\theta 2) - 1)}{4} \right) \cdot r$
-----2	2
$2 \cdot \left(\int_0^{\frac{\pi}{2}} \left(\frac{m1^2}{2 \cdot ei} \cdot r \right) d\theta 1 + \int_0^{\frac{\pi}{2}} \left(\frac{m2^2}{2 \cdot ei} \cdot \frac{r}{2} \right) d\theta 2 \right) \rightarrow u$	$\frac{9 \cdot (4 \cdot h^2 \cdot \pi - 8 \cdot h \cdot p + p^2 \cdot (3 \cdot \pi - 8)) \cdot r^3}{128 \cdot ei}$
-----3	-3
$\triangle \text{ solve } \left(\frac{d}{dh}(u) = 0, h \right)$	$h = \frac{p}{\pi} \text{ or } r = 0$
-----4	4
-----4.1	-4.1

$$\text{solve}\left(\frac{d}{d\theta 1}(m1)=0,\theta 1\right)|h=\frac{p}{\pi}$$

$$\theta 1=3.14159 \cdot n10+0.566912 \text{ or } p \cdot r=0.$$

$$\frac{0.566912 \cdot 180}{\pi}$$

$$32.4817$$

$$\text{solve}(m1=0,\theta 1)|h=\frac{p}{\pi}$$

$$\theta 1=6.28319 \cdot n11 \text{ or } \theta 1=6.28319 \cdot n11+1.13382 \text{ or } p \cdot r=0.$$

$$1.13382 \cdot \frac{180}{\pi}$$

$$64.9631$$

$$m1|\theta 1=0.566912 \text{ and } h=\frac{p}{\pi}$$

$$-0.092724 \cdot p \cdot r$$

$$m1|\theta 1=\frac{\pi}{2} \text{ and } h=\frac{p}{\pi}$$

$$0.18169 \cdot p \cdot r$$

$$\text{-----}4.2$$

$$-4.2$$

$$\text{solve}\left(\frac{d}{d\theta 2}(m2)=0,\theta 2\right)|h=\frac{p}{\pi}$$

$$\theta 2=3.14159 \cdot n12+0.566912 \text{ or } p \cdot r=0.$$

$$\frac{0.566912 \cdot 180}{\pi}$$

$$32.4817$$

$$\text{solve}(m_2=0, \theta_2) | h = \frac{p}{\pi}$$

$$\theta_2 = 6.28319 \cdot n13 \text{ or } \theta_2 = 6.28319 \cdot n13 + 1.13382 \text{ or } p \cdot r = 0.$$

$$\frac{1.13382 \cdot 180}{\pi}$$

$$64.9631$$

$$m_2 | \theta_2 = 0.566912 \text{ and } h = \frac{p}{\pi}$$

$$-0.046362 \cdot p \cdot r$$

$$m_2 | \theta_2 = \frac{\pi}{2} \text{ and } h = \frac{p}{\pi}$$

$$0.090845 \cdot p \cdot r$$

[]

-----1

1

$$q \cdot x \rightarrow m1$$

$$q \cdot x$$

$$w \cdot r^2 \cdot (1 - \cos(\theta)) - q \cdot r \cdot \sin(\theta) - \frac{w \cdot r^2 \cdot (1 - \cos(\theta))^2}{2} \rightarrow m2$$

$$\frac{-(\cos(\theta) - 1) \cdot (\cos(\theta) + 1) \cdot r^2 \cdot w}{2} - q \cdot \sin(\theta) \cdot r$$

$$\left(\int_0^h \frac{m1^2}{2 \cdot ei} dx + \int_0^{\frac{\pi}{2}} \left(\frac{m2^2}{2 \cdot ei} \cdot r \right) d\theta \right) \cdot 2 \rightarrow u$$

$$\frac{9 \cdot \pi \cdot r^5 \cdot w^2 - 128 \cdot q \cdot r^4 \cdot w + 48 \cdot q^2 \cdot \pi \cdot r^3 + 64 \cdot h^3 \cdot q^2}{192 \cdot ei}$$

-----2

-2

$$\triangle \text{ solve } \left(\frac{d}{dq}(u) = 0, q \right)$$

$$q = \frac{4 \cdot r^4 \cdot w}{3 \cdot \pi \cdot r^3 + 4 \cdot h^3}$$

-----3.1

3.1

$$\triangle q = \frac{4 \cdot r^4 \cdot w}{3 \cdot \pi \cdot r^3 + 4 \cdot h^3} |_{h=r}$$

$$q = \frac{4 \cdot r \cdot w}{3 \cdot \pi + 4}$$

$$\text{solve}\left(\frac{d}{d\theta}(m2)=0,\theta\right)|q=\frac{4\cdot r\cdot w}{3\cdot \pi+4} \quad \theta=\frac{(2\cdot n5-1)\cdot \pi}{2} \text{ or } \theta=2\cdot n6\cdot \pi+\sin^{-1}\left(\frac{4}{3\cdot \pi+4}\right) \text{ or } \theta=2\cdot n6\cdot \pi-\sin^{-1}\left(\frac{4}{3\cdot \pi+4}\right)+\pi \text{ or } r^2\cdot w=0$$

$$\frac{(2-1)\cdot \pi}{2}\cdot \frac{180}{\pi} \quad 90$$

$$\sin^{-1}\left(\frac{4}{3\cdot \pi+4}\right)\cdot \frac{180}{\pi} \quad 17.3349$$

$$\text{solve}(m2=0,\theta)|q=\frac{4\cdot r\cdot w}{3\cdot \pi+4} \quad \theta=2\cdot n7\cdot \pi+\sin^{-1}\left(\frac{8}{3\cdot \pi+4}\right) \text{ or } \theta=2\cdot n7\cdot \pi-\sin^{-1}\left(\frac{8}{3\cdot \pi+4}\right)+\pi \text{ or } \theta=n8\cdot \pi \text{ or } r^2\cdot w=0$$

$$\sin^{-1}\left(\frac{8}{3\cdot \pi+4}\right)\cdot \frac{180}{\pi} \quad 36.5777$$

$$m2|q=\frac{4\cdot r\cdot w}{3\cdot \pi+4} \text{ and } \theta=\left\{ 17.334907692093^\circ, 36.577746746371^\circ, 90^\circ \right\}$$

$$\left\{ -0.044389\cdot r^2\cdot w, -1.E-14\cdot r^2\cdot w, 0.202043\cdot r^2\cdot w \right\}$$

$$\text{-----}3.2 \quad 3.2$$

$$\triangle q=\frac{4\cdot r^4\cdot w}{3\cdot \pi\cdot r^3+4\cdot h^3}|h=0 \quad q=\frac{4\cdot r\cdot w}{3\cdot \pi}$$

$$\text{solve}\left(\frac{d}{d\theta}(m2)=0,\theta\right)|q=\frac{4\cdot r\cdot w}{3\cdot \pi} \qquad \theta=\frac{(2\cdot \textcolor{red}{n11}-1)\cdot \pi}{2} \text{ or } \theta=2\cdot \textcolor{red}{n12}\cdot \pi+\sin^{-1}\left(\frac{4}{3\cdot \pi}\right) \text{ or } \theta=2\cdot \textcolor{red}{n12}\cdot \pi-\sin^{-1}\left(\frac{4}{3\cdot \pi}\right)+\pi \text{ or } r^2\cdot w=0$$

$$\frac{(2-1)\cdot \pi}{2}\cdot \frac{180}{\pi} \qquad \qquad \qquad 90.$$

$$\sin^{-1}\left(\frac{4}{3\cdot \pi}\right)\cdot \frac{180}{\pi} \qquad \qquad \qquad 25.1135$$

$$\text{solve}(m2=0,\theta)|q=\frac{4\cdot r\cdot w}{3\cdot \pi}$$

$$\theta=2\cdot \textcolor{red}{n13}\cdot \pi+\cos^{-1}\left(\frac{\sqrt{9\cdot \pi^2-64}}{3\cdot \pi}\right) \text{ or } \theta=2\cdot \textcolor{red}{n13}\cdot \pi-\cos^{-1}\left(\frac{\sqrt{9\cdot \pi^2-64}}{3\cdot \pi}\right)+\pi \text{ or } \theta=\textcolor{red}{n14}\cdot \pi \text{ or } r^2\cdot w=0$$

$$\cos^{-1}\left(\frac{\sqrt{9\cdot \pi^2-64}}{3\cdot \pi}\right)\cdot \frac{180}{\pi} \qquad \qquad \qquad 58.0842$$

$$m2|q=\frac{4\cdot r\cdot w}{3\cdot \pi} \text{ and } \theta=\left\{ 25.113525373544^\circ, 58.084246713564^\circ, 90^\circ \right\}$$

$$\left\{ -0.090063\cdot r^2\cdot w, -1.E-14\cdot r^2\cdot w, 0.075587\cdot r^2\cdot w \right\}$$

$$m_2|_{q=0} \text{ and } \theta=90^\circ$$

$$0.5 \cdot r^2 \cdot w$$



-----1

1

$$\text{solve}(ha \cdot a - ra \cdot a = 0, ha) | ra = \frac{p}{2}$$

$$ha = \frac{p}{2} \text{ or } a = 0$$

-----2

2

$$\frac{-p}{2} \cdot a \cdot \sin(\theta) + \frac{p}{2} \cdot a \cdot (1 - \cos(\theta)) \rightarrow m$$

$$a \cdot p \cdot \left(\frac{-\cos(\theta)}{2} - \frac{\sin(\theta)}{2} + \frac{1}{2} \right)$$

$$\text{solve}\left(\frac{d}{d\theta}(m) = 0, \theta\right)$$

$$\theta = \frac{(4 \cdot \mathbf{n1} - 3) \cdot \pi}{4} \text{ or } a \cdot p = 0$$

$$\frac{(4-3) \cdot \pi}{4}$$

$$0.785398$$

$$m|_{\theta} = \frac{(4-3) \cdot \pi}{4}$$

$$-0.207107 \cdot a \cdot p$$

-----3

3

$$\frac{p}{2} \cdot \sin(\theta) - \frac{p}{2} \cdot \cos(\theta) \rightarrow v$$

$$p \cdot \left(\frac{\sin(\theta)}{2} - \frac{\cos(\theta)}{2} \right)$$

$$\frac{-p}{2}\cdot\cos(\theta)-\frac{p}{2}\cdot\sin(\theta)\rightarrow n$$

$$p\cdot\left(\frac{-\cos(\theta)}{2}-\frac{\sin(\theta)}{2}\right)$$

$$v|\theta=\frac{\pi}{4} \qquad \qquad \qquad 0$$

$$n|\theta=\frac{\pi}{4} \qquad \qquad \qquad \frac{-p\cdot\sqrt{2}}{2}$$

$$\square$$

-----1. function

-function

$$\text{solve} \left(\begin{cases} y = a \cdot x^2 + b \cdot x + c | x=0 \text{ and } y=0 \\ y = a \cdot x^2 + b \cdot x + c | x = \frac{l}{2} \text{ and } y=h, \{a, b, c\} \\ y = a \cdot x^2 + b \cdot x + c | x=l \text{ and } y=0 \end{cases} \right)$$

$$a = \frac{-4 \cdot h}{l^2} \text{ and } b = \frac{4 \cdot h}{l} \text{ and } c=0 \text{ or } a = \mathbf{c4} \text{ and } b = \mathbf{c3} \text{ and } c=0 \text{ and } h=0 \text{ and } l=0$$

$$a \cdot x^2 + b \cdot x + c | a = \frac{-4 \cdot h}{l^2} \text{ and } b = \frac{4 \cdot h}{l} \text{ and } c=0 \rightarrow y$$

$$\frac{4 \cdot h \cdot x}{l} - \frac{4 \cdot h \cdot x^2}{l^2}$$

-----2. reaction

2. reaction

$$\text{solve} \left(\begin{cases} ha-hb=0 \\ va+vb-w \cdot l=0 \\ -l \cdot vb+\frac{w \cdot l \cdot l}{2}=0 \\ \frac{-vb \cdot l}{2}+hb \cdot h+\frac{\frac{w \cdot l}{2} \cdot l}{4}=0 \end{cases}, \{va,vb,ha,hb\} \mid l>0 \text{ and } h>0 \right)$$


$$h>0 \text{ and } l>0 \text{ and } ha=\frac{l^2 \cdot w}{8 \cdot h} \text{ and } hb=\frac{l^2 \cdot w}{8 \cdot h} \text{ and } va=\frac{l \cdot w}{2} \text{ and } vb=\frac{l \cdot w}{2}$$

-----3

-3

-----4. *mx*


-4. *mx*

 $va \cdot x - ha \cdot y - \frac{w \cdot x^2}{2} \mid ha=\frac{l^2 \cdot w}{8 \cdot h} \text{ and } va=\frac{l \cdot w}{2}$

0

-----5. *shear*

-5. *shear*

 $-ha \cdot \sin(\theta) + va \cdot \cos(\theta) - w \cdot x \cdot \cos(\theta) \mid ha=\frac{l^2 \cdot w}{8 \cdot h} \text{ and } va=\frac{l \cdot w}{2} \text{ and } \sin(\theta)=\frac{-8 \cdot h}{l^2} \cdot \left(x - \frac{l}{2}\right) \cdot \cos(\theta)$

0

-----6. axial force

-6. axial force

$$\triangle -ha \cdot \cos(\theta) + w \cdot \frac{-ha}{w} \cdot \frac{\sin(\theta)}{\cos(\theta)} \cdot \sin(\theta) | ha = \frac{l^2 \cdot w}{8 \cdot h}$$

$$\frac{-l^2 \cdot w}{8 \cdot h \cdot \cos(\theta)}$$

[]

-----1. function

-function

$$\text{solve} \left(\begin{cases} y = a \cdot x^2 + b \cdot x + c | x=0 \text{ and } y=0 \\ y = a \cdot x^2 + b \cdot x + c | x = \frac{l}{2} \text{ and } y=h, \{a,b,c\} \\ y = a \cdot x^2 + b \cdot x + c | x=l \text{ and } y=0 \end{cases} \right)$$

$$a = \frac{-4 \cdot h}{l^2} \text{ and } b = \frac{4 \cdot h}{l} \text{ and } c=0 \text{ or } a = \mathbf{c2} \text{ and } b = \mathbf{c1} \text{ and } c=0 \text{ and } h=0 \text{ and } l=0$$

$$a \cdot x^2 + b \cdot x + c | a = \frac{-4 \cdot h}{l^2} \text{ and } b = \frac{4 \cdot h}{l} \text{ and } c=0 \rightarrow y$$

$$\frac{4 \cdot h \cdot x}{l} - \frac{4 \cdot h \cdot x^2}{l^2}$$

-----2. reaction

2. reaction

$$\text{solve} \left\{ \begin{array}{l} ha-hb=0 \\ va+vb-w \cdot l=0 \\ -l \cdot vb+\frac{w \cdot l \cdot l}{2}=0 \\ \frac{-vb \cdot l}{2}+hb \cdot h+\frac{\frac{w \cdot l}{2} \cdot l}{4}=0 \end{array} \right. , \{va, vb, ha, hb\} | h>0 \text{ and } l>0$$

$$h>0 \text{ and } l>0 \text{ and } ha=\frac{l^2 \cdot w}{8 \cdot h} \text{ and } hb=\frac{l^2 \cdot w}{8 \cdot h} \text{ and } va=\frac{l \cdot w}{2} \text{ and } vb=\frac{l \cdot w}{2}$$

-----4. *mx*

-4. *mx*

$$\triangle va \cdot x - ha \cdot y - \frac{w \cdot x^2}{2} | ha=\frac{l^2 \cdot w}{8 \cdot h} \text{ and } va=\frac{l \cdot w}{2}$$

0

-----5. *shear*

-5. *shear*

$$\triangle -ha \cdot \sin(\theta) + va \cdot \cos(\theta) - w \cdot x \cdot \cos(\theta) | ha=\frac{l^2 \cdot w}{8 \cdot h} \text{ and } va=\frac{l \cdot w}{2} \text{ and } \sin(\theta)=\frac{-8 \cdot h}{l^2} \cdot \left(x - \frac{l}{2}\right) \cdot \cos(\theta)$$

0

-----6. *axial force*

-6. *axial force*

$$\triangle -ha \cdot \cos(\theta) + w \cdot \frac{-ha}{w} \cdot \frac{\sin(\theta)}{\cos(\theta)} \cdot \sin(\theta) | ha = \frac{l^2 \cdot w}{8 \cdot h}$$

$$\frac{-l^2 \cdot w}{8 \cdot h \cdot \cos(\theta)}$$

□