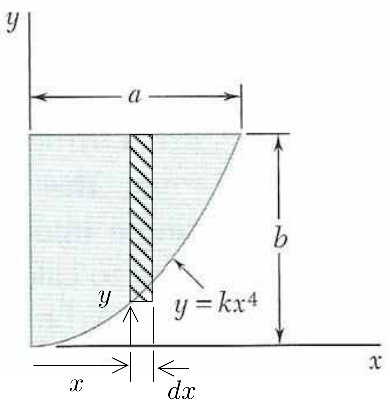
{9.1~9.5절}



9.4&8　$y = k\,x^4 \qquad (a,\ b) \ \Rightarrow \ b = k\,a^4$

$\Rightarrow \quad k = \dfrac{b}{a^4} \quad \Rightarrow \quad y = \dfrac{b}{a^4}\,x^4$

$dA = (b-y)\,dx$

$dI_y = x^2\,dA = x^2\,(b-y)\,dx$

$$I_y = \int dI_y = \int_0^a x^2\,(b-y)\,dx = \int_0^a x^2\left(b - \frac{b}{a^4}\,x^4\right)dx$$

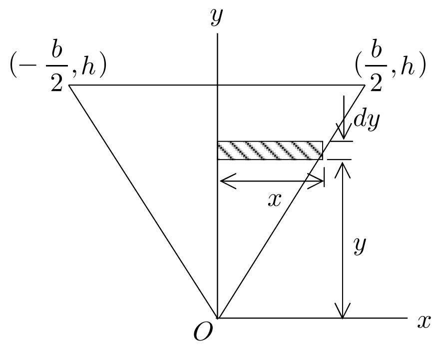
$$= \int_0^a \left(b\,x^2 - \frac{b}{a^4}\,x^6\right)dx = \left[\frac{b}{3}\,x^3 - \frac{b}{7\,a^4}\,x^7\right]_0^a$$

$$= \frac{b}{3}\,a^3 - \frac{b}{7\,a^4}\,a^7 = \frac{4}{21}\,a^3\,b$$

$$d\,I_x = \frac{1}{3}\,b^3\,dx - \frac{1}{3}\,y^3\,dx$$

$$I_x = \int dI_x = \int_0^a \frac{1}{3}\,b^3\,dx - \int_0^a \frac{1}{3}\,y^3\,dx = \frac{b^3}{3}\int_0^a dx - \frac{1}{3}\int_0^a \left(\frac{b}{a^4}x^4\right)^3 dx$$

$$= \frac{b^3}{3}\,a - \frac{1}{3}\,\frac{b^3}{a^{12}}\left(\frac{1}{13}a^{13}\right) = \frac{1}{3}\,a\,b^3\left(1 - \frac{1}{13}\right) = \frac{4}{13}\,a\,b^3$$



9.28　$y = \dfrac{h}{b/2}\,x = \dfrac{2h}{b}\,x, \quad x = \dfrac{b}{2h}\,y$

I_x ;　$dA = x\,dy = \dfrac{b}{2h}\,y\ \ dy$

$$dI_x = y^2\,dA = y^2\left(\frac{b}{2h}\,y\ dy\right) = \frac{b}{2h}\,y^3\,dy$$

$$I_x = 2\int dI_x = 2\int_0^h \frac{b}{2h}\,y^3\,dy = \frac{b}{h}\left[\frac{1}{4}\,y^4\right]_0^h = \frac{1}{4}\,b\,h^3$$

I_y ;　$dI_y = \dfrac{1}{3}\,x^3\,dy = \dfrac{1}{3}\left(\dfrac{b}{2h}y\right)^3 dy = \dfrac{b^3}{24\,h^3}\,y^3\,dy$

$$I_y = 2\int_0^h dI_y = 2\int_0^h \frac{b^3}{24\,h^3}\,y^3\,dy = \frac{b^3}{12\,h^3}\left[\frac{1}{4}y^4\right]_0^h = \frac{1}{48}\,b^3\,h$$

$$J_O = I_x + I_y = \frac{1}{4}\,b\,h^3 + \frac{1}{48}\,b^3\,h = \frac{1}{48}\,b\,h\left(12\,h^2 + b^2\right)$$

$$k_O = \sqrt{\frac{J_O}{A}} = \sqrt{\frac{\frac{1}{48}\,b\,h\,(12\,h^2 + b^2)}{\frac{1}{2}\,b\,h}} = \sqrt{\frac{12\,h^2 + b^2}{24}}$$