

{9.2절}

9.43 Centroid

① 직사각판  $a = 0.9 + 2.0 + 2.1 \text{ cm} = 5.0 \text{ cm}$

$b = 1.8 + 5.0 + 1.2 \text{ cm} = 8.0 \text{ cm}$

$A = (5.0 \text{ cm})(8.0 \text{ cm}) = 40.0 \text{ cm}^2$

$\bar{x} = \frac{1}{2}a = \frac{1}{2}(5.0 \text{ cm}) = 2.5 \text{ cm}$

$\bar{y} = \frac{1}{2}b = \frac{1}{2}(8.0 \text{ cm}) = 4.0 \text{ cm}$

② 직사각형 구멍

$A = -(2.0 \text{ cm})(5.0 \text{ cm}) = -10.0 \text{ cm}^2$

$\bar{x} = (0.9 \text{ cm}) + \frac{1}{2}(2.0 \text{ cm}) = 1.9 \text{ cm}$

$\bar{y} = (1.8 \text{ cm}) + \frac{1}{2}(5.0 \text{ cm}) = 4.3 \text{ cm}$

$\Sigma A = (40.0 \text{ cm}^2) + (-10.0 \text{ cm}^2) = 30.0 \text{ cm}^2$

$\Sigma(\bar{x}A) = (2.5 \text{ cm})(40.0 \text{ cm}^2) + (1.9 \text{ cm})(-10.0 \text{ cm}^2) = 81.0 \text{ cm}^3$

$\Sigma(\bar{y}A) = (4.0 \text{ cm})(40.0 \text{ cm}^2) + (4.3 \text{ cm})(-10.0 \text{ cm}^2) = 117.0 \text{ cm}^3$

$\bar{X} = \frac{\Sigma(\bar{x}A)}{\Sigma A} = \frac{81.0 \text{ cm}^3}{30.0 \text{ cm}^2} = 2.70 \text{ cm}$

$\bar{Y} = \frac{\Sigma(\bar{y}A)}{\Sigma A} = \frac{117.0 \text{ cm}^3}{30.0 \text{ cm}^2} = 3.90 \text{ cm}$

$I_{x1} = \bar{I}_{x1} + A_1 d_1^2$

$= \frac{1}{12}(5.0 \text{ cm})(8.0 \text{ cm})^3 + (40.0 \text{ cm}^2)(4.0 - 3.9 \text{ cm})^2$

$= 213.73 \text{ cm}^4$

$I_{x2} = \bar{I}_{x2} + A_2 d_2^2$

$= \frac{1}{12}(2.0 \text{ cm})(5.0 \text{ cm})^3 + (10.0 \text{ cm}^2)(4.3 - 3.9 \text{ cm})^2$

$= 22.43 \text{ cm}^4$

$I_x = I_{x1} - I_{x2}$

$= (213.73 \text{ cm}^4) - (22.43 \text{ cm}^4) = 191.3 \text{ cm}^4$

$I_{y1} = \bar{I}_{y1} + A_1 d_1^2$

$= \frac{1}{12}(5.0 \text{ cm})^3(8.0 \text{ cm}) + (40.0 \text{ cm}^2)(2.7 - 2.5 \text{ cm})^2 = 84.93 \text{ cm}^4$

$I_{y2} = \bar{I}_{y2} + A_2 d_2^2 = \frac{1}{12}(2.0 \text{ cm})^3(5.0 \text{ cm}) + (10.0 \text{ cm}^2)(2.7 - 1.9 \text{ cm})^2 = 9.73 \text{ cm}^4$

$I_y = I_{y1} - I_{y2}$

$= (84.93 \text{ cm}^4) - (9.73 \text{ cm}^4) = 75.2 \text{ cm}^4$

